Chapter 9

Conservation Measures for Terrestrial Habitat

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9 CONSERVATION MEASURES FOR TERRESTRIAL HABITAT

9.1 Introduction

Chapter 9 addresses the conservation measures for terrestrial habitat under the separate topics of snags, wildlife trees, and downed wood; hardwoods; old growth; rocky outcrops; and natural communities. Each of these sub-sections includes goals and objectives, conservation measures, and rationales.

9.2 Snags, Downed Wood, and Wildlife Trees

9.2.1 Overview

Snags, downed wood, and wildlife trees add complexity to forest habitat and provide critical elements for the survival of many species; all are essential to a healthy forest ecosystem. MRC maintains these existing elements in our forests and provides for their additional recruitment.

DEFINITION

A **snag** is any standing dead tree.

Downed wood is any tree or part of a tree that rests on the forest floor as a result of natural causes (e.g., windfall and fire) or deliberate felling for the specific purposes of creating downed wood.

A **wildlife tree** is any standing live or dead tree that possesses special and uncommon characteristics providing valuable habitat for wildlife.

A **recruitment tree** is a standing live tree that is retained during a harvest in order to develop into a snag or wildlife tree in an area deficient in these habitat elements; recruitment trees are generally older, larger trees that exhibit signs of decadence, deformity, or structure.

9.2.1.1 Snags

A popular misconception is that a healthy forest is composed entirely of beautiful, proportioned, living trees. In reality, snags or dead trees are also part of a healthy forest and play a critical role in MRC conservation measures for wildlife habitat. Snags are classified as either hard or soft.

DEFINITION

A **hard snag** is composed primarily of sound wood; its top is intact as well as some of its branches and most of its bark, although a redwood hard snag may actually lack considerable bark.

A **soft snag** is composed of wood softened by weather, insects, and fungal rot; its top is generally missing, as well as its bark and branches.

Hard snags provide nest sites and food sources for wildlife while soft snags provide recruitment for downed logs. As they decompose, hard snags become soft snags. Consequently, MRC chooses to concentrate our efforts on maintaining enough hard snags to provide sufficient nest sites as well as potential recruitment for downed logs.

9.2.1.2 Downed wood

Downed wood includes downed logs and large limbs on the forest floor. As a key element of redwood ecology, this woody debris provides habitat and food sources for small animals and *mesocarnivores*, like ringtail, marten, and fisher, as well as nutrient cycling for the forest ecosystem. It also provides a moist microclimate for various plants and animals, including many mosses, invertebrates, and terrestrial amphibians. As wood decays, a downed log contributes additional nutrients to the forest. Downed wood can be either hard or soft logs.

DEFINITION

A **hard log** consists of primarily sound wood with mostly intact bark, although a redwood hard log may actually lack considerable bark.

A **soft log** consists of wood softened by weather, insects, and fungal rot, with most of its bark missing.

Hard logs provide shelter while soft logs provide food for forest animals. As they decompose, hard logs become soft logs. Consequently, MRC chooses to concentrate our efforts on maintaining enough hard logs to provide sufficient animal shelter and potentially recruit as soft logs. Figure 9-1 illustrates stages of decay in downed wood.

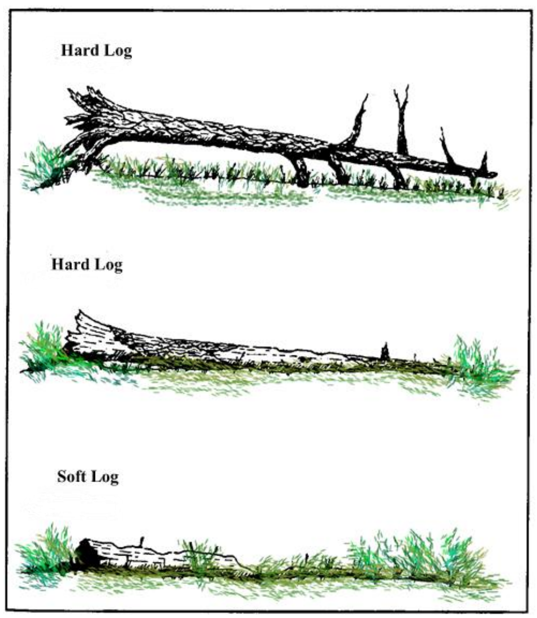

Figure 9-1 Decaying Log

9.2.1.3 Wildlife trees

Wildlife trees provide valuable attributes for wildlife. MRC has established numerical objectives for wildlife trees; we will mark these trees for retention during the PTHP process.

Wildlife trees are[1]

- Old-growth trees.
- Primary murrelet trees (see section 10.3.2.3.5).
- Trees in which the diameter of the entrance hole leading to a cavity is greater than 3 in. and 10 ft or more above the ground.
- Trees over 24 in. dbh with basal hollows that are more than 12 in. in any horizontal dimension and extend at least 6 in. vertically inside the cavity from the topmost point of the entrance hole (Figure 9-2).
- Trees with known raptor nests.
- Granary trees.

DEFINITION	A **granary tree** has at least 100 small holes on the tree that are either filled with acorns or capable of containing acorns.[2]

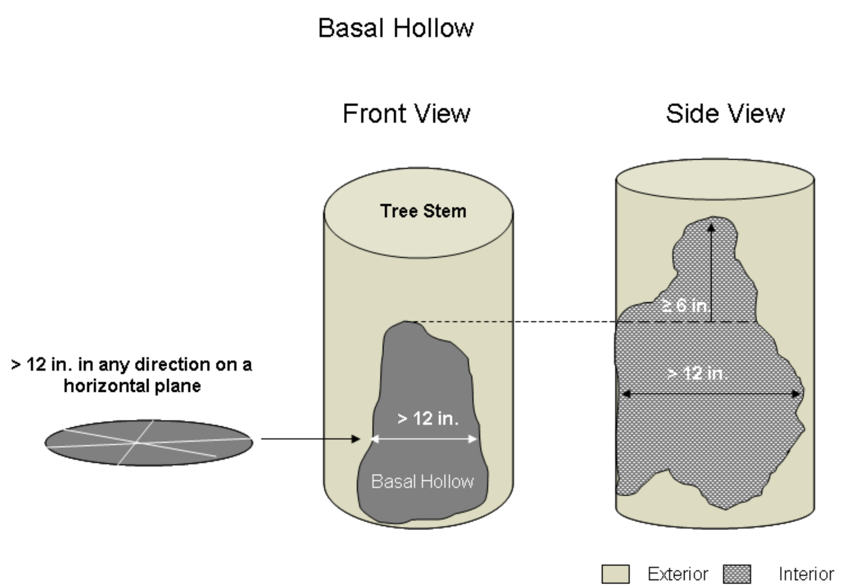

Figure 9-2 Basal Hollow Dimensions

9.2.1.4 Recruitment trees

A recruitment tree should show imminent potential to become a hard snag or wildlife tree. Generally, recruitment trees are larger and older trees that exhibit signs of decadence, deformity, or structure. In the selection of recruitment trees, whitewoods are preferable to redwoods but not to the exclusion of redwoods. MRC manages the plan area for hard snags and wildlife trees. In Figure 9-3, illustrations 1 and 2 are potential recruitment trees; 3, 4, and 5 are hard snags; 6 is a soft snag.

[1] MRC and the wildlife agencies recognize that during the term of this plan we may learn of other attributes that are highly valuable to wildlife. If either MRC or the wildlife agencies determine that we should add or change attributes, we will meet and confer. Changes or additions to the attribute list require concurrence of both MRC and the wildlife agencies.

[2] In an e-mail to Robert Douglas (MRC) on 1/31/06, Dr. Walter Koenig (UC-Berkeley) suggested this definition.

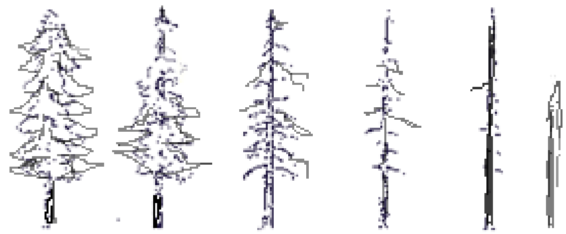

Figure 9-3 Snags and Snag Recruitment Trees

9.2.2 Goals and objectives

Goals and Objectives for Snags, Downed Wood, and Wildlife Trees	
Goals	
G§9.2.2-1	Retain and recruit snags in managed stands and downed wood on the forest floor.
G§9.2.2-2	Retain all wildlife trees.
G§9.2.2-3	Manage wildlife trees and downed wood so that they ▪ Are well distributed across the forest—in both riparian and upslope areas, in groups and singly. ▪ Exist in sufficient quantity and quality across the forest.
Objectives	
O§9.2.2-1	Retain[3] in Class I and Large Class II AMZ at least ▪ 1 hard snag or recruitment tree *on average per acre*[4] that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 2 hard snags or recruitment trees o*n average per acre* that are ≥ 24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 6 hard logs *on average* per acre that are (a) ≥ 16 in. average diameter, (b) ≥6 ft long, and (c) derived from at least 3 trees.
O§9.2.2-2	Retain in general forested areas at least [5] ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥ 24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 5 hard logs *on average per acre* that are (a) ≥ 16 in. average diameter, (b) ≥ 6 ft long, and (c) derived from at least 3 trees.

[3] MRC may retain trees without marking or counting them. We will only mark and count trees in Class I and Large Class II AMZs if harvest will occur there.
[4] MRC calculated the value by silvicultural unit and then standardized the value per acre.
[5] These areas exclude designated core areas of northern spotted owls, as well as Class I and Large Class II AMZs.

9.2.2.1 Implementation contingencies

9.2.2.1.1 Snags and wildlife trees

DEFINITION

A **silvicultural unit** is an area within a PTHP with only 1 type of silviculture that is non-contiguous with other areas of that same type (Figure 9-4).

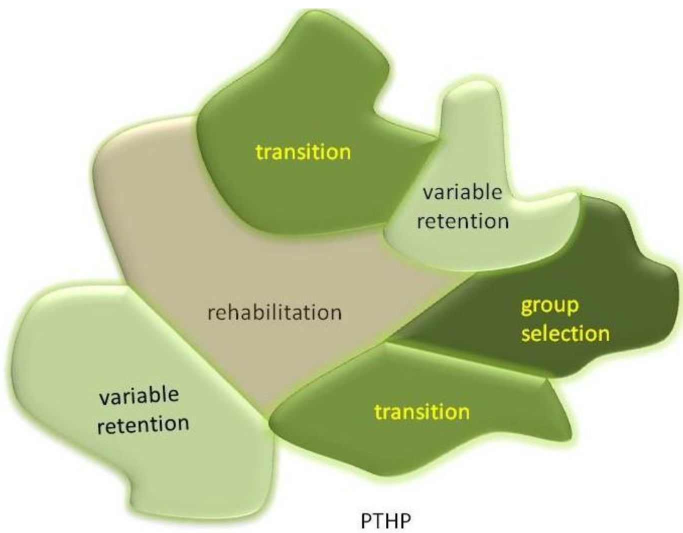

Figure 9-4 PTHP with Silvicultural Units

Intent of the implementation contingencies
The intent of the implementation contingencies is to retain in general forested areas snags and wildlife trees and, if density is low, to recruit *on average* 3 trees per acre. MRC will retain a recruitment tree during subsequent entries for harvest unless (a) it is no longer standing, or (b) there are better choices now for a wildlife recruitment tree in the silvicultural unit, or (c) the number of new wildlife trees in the silvicultural unit already meets or exceeds the target number of wildlife trees per acre. MRC expects wildlife trees and snags to provide the "highest value" habitat for wildlife. Therefore, once MRC meets or exceeds the target number of snags, wildlife trees, and recruitment trees in a silvicultural unit, we may harvest any recruitment tree in that area of equal or lesser value to wildlife.

Recognizing the limitation of forest inventory
A forest is a dynamic environment. New trees are continually sprouting; old trees are decaying, dying, and falling. At the time MRC assesses a silvicultural unit for snags and wildlife trees, we will substantiate that the unit contains the requisite number of wildlife trees, snags, and recruitment trees, i.e., *on average* 2 hard snags and 1wildlife tree or an equivalent combination of recruitment trees per acre in upland forests. We cannot guarantee how long those trees will remain or in what condition. After a harvest, a managed stand may not be re-visited for 10 or even 40 or 50 years, depending on the silviculture. During that time, a living tree might become a snag. A snag might topple and become downed wood. A tree recruited as a potential snag might still be vigorous 50 years later. Realistically, at any point in time post-harvest, there is no way to guarantee that a silvicultural unit has the same wildlife trees, snags, or recruitment trees targeted and marked by MRC during an inventory. What we can guarantee is that we are continually

managing the entire plan area for 2 snags and 1 wildlife tree, *on average* per acre, in general forested areas—and we may, in fact, exceed that target.

Linking objectives for snags and wildlife trees to the PTHP process

MRC is proposing that, to be workable, the objectives for wildlife trees and snags must be implemented through the PTHP process. As part of the PTHP process, a registered professional forester (RPF) or a designee from MRC will do an on-site field visit or pre-harvest assessment of a silvicultural unit. At that time, the RPF or a designee will determine if there is the requisite number of snags and wildlife trees in the silvicultural unit, recruit additional trees if necessary, and paint their bark with a "W" for snag and wildlife trees or an "R" for recruitment tree. MRC recognizes that worker safety is the number one priority in the forest, and a tree initially designated as a snag, wildlife tree, or recruitment tree may, in fact, present a safety hazard and need to be felled. If MRC fells a snag or wildlife tree for safety reasons, we will designate a new tree as a recruitment tree during harvest operations. By doing assessment and recruitment during the PTHP process, we will not only ensure that MRC is in compliance with HCP/NCCP objectives but that we are systematically covering the entire plan area as each new PTHP is initiated.

First entry into a silvicultural unit after HCP/NCCP commencement

MRC will initiate new PTHPs once the term of the HCP/NCCP commences. When MRC enters a silvicultural unit for this post-commencement harvest, we will assess whether there are already the requisite number of snags and wildlife trees per acre. If not, MRC will make up for the deficiency by recruiting additional trees within the silvicultural unit. In selecting recruitment trees, MRC will choose whitewoods over redwoods, larger trees over smaller trees, and trees with obvious signs of rot. We will look for trees that have the most attributes valuable for wildlife or that will likely develop such attributes, namely

- Secondary murrelet trees.
- Trees with less than 10% live crown and no terminal leader.
- Whitewoods likely to become snags, evidenced, for example, by conk (wood-rotting fungus) or fire scars.
- Trees with basal hollows that do not yet meet the definition for a wildlife tree.
- Trees with broken tops, forked tops, or reiterated crowns.
- Trees with large limbs.
- Trees with old-growth characteristics (see section 9.4.1.3).[6]
- Trees with vegetative deformities (e.g., witches broom).
- Trees in the upper 20th percentile for dbh within the silvicultural unit (i.e., large trees).
- Trees with usnea (uncommon lichen).

To meet HCP/NCCP objectives, a forester may recruit trees in any acceptable area of the silvicultural unit. Trees for upland forest, for example, cannot be recruited from a Large Class II AMZ. This is necessary because snags and wildlife trees are often patchily distributed. Table 9-1 shows how the number of recruitment trees in a silvicultural unit relates both to the current number of snags and wildlife trees in that silvicultural unit and to the location of the silvicultural unit. The table only addresses the first entry into a silvicultural unit following HCP/NCCP implementation of the plan. In later entries, MRC foresters will also need to retain previous

[6] Each old-growth attribute counts as one in the decision-making for recruitment trees.

recruitment trees, unless an alternative tree has grown into a better recruitment tree or actually become a snag or wildlife tree.

Table 9-1 Recruiting Snags and Wildlife Trees

Location of PTHP Unit	Average Number of Snags and Wildlife Trees per Acre Currently in PTHP Unit	Snag and Wildlife Recruitment Trees per Acre Required in PTHP Unit
General Forest	0	3
	1	2
	2	1
	3	0
Class I and Large Class II AMZ	0	4
	1	3
	2	2
	3	1
	4	0

Figure 9-5 illustrates a silvicultural unit in a general forested area that is deficient in snags and wildlife trees at the time of inventory. There are 16 ac in the sample silvicultural unit. According to our HCP/NCCP objectives, such a unit must have an *average* of 2 snags or 2 recruitment trees per acre and an average of 1 wildlife tree or 1 recruitment tree per acre. This comes to 32 snags and 16 wildlife trees or a sufficient number of recruitment trees to make up any disparity. In fact, in this example there are only 28 snags and wildlife trees.

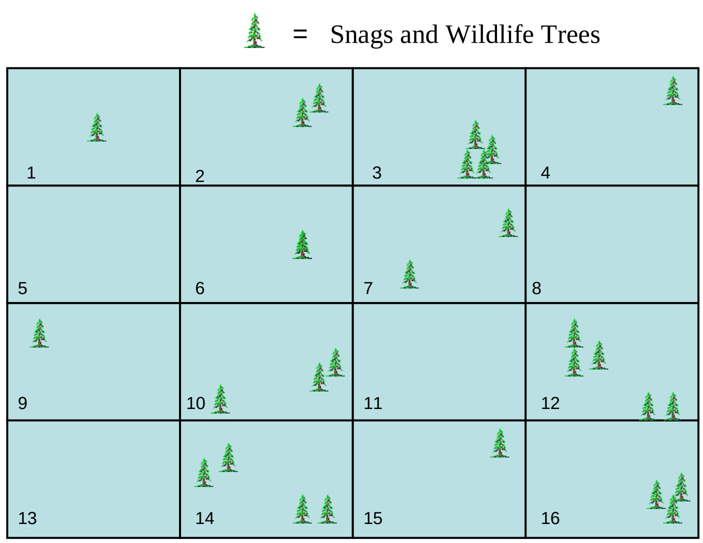

Figure 9-5 Silvicultural Unit in One Acre Plots - Before PTHP

To bring this silvicultural unit up to our HCP/NCCP objective, an MRC forester would need to mark an additional 20 recruitment trees. Figure 9-6 shows that the forester recruited 3 trees in acre-5, 1 in acre-6, 4 in acre-15, 5 in acre-8, 5 in acre-13, and 2 in acre-11. This brings the total number of snags, wildlife trees, and recruitment trees for the silvicultural unit up to 48 or an *average* of 2 snags and 1 wildlife tree per acre—sufficient numbers to make up for any initial deficiencies in snags or wildlife trees. While Figures 9-5 and 9-6 appear to be two stages of one process, in reality a forester would only walk through a stand once to assess the number of snags and wildlife trees and designate recruitment trees.

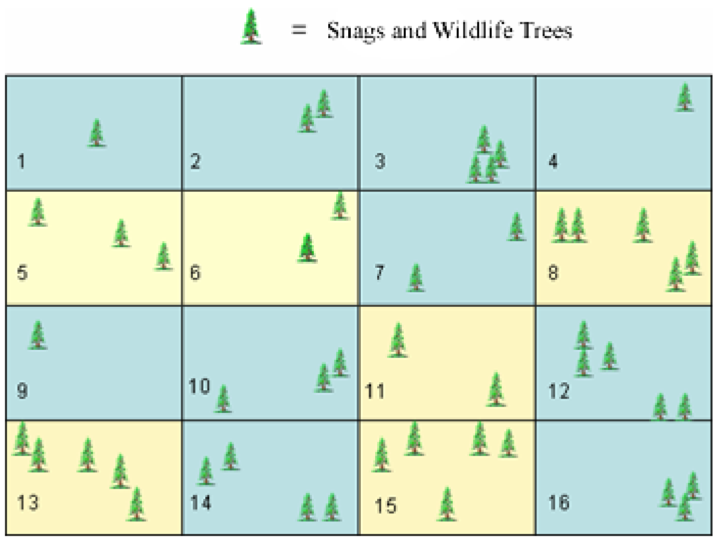

Figure 9-6 Silvicultural Unit in One Acre Plots - After PTHP

Subsequent entries into a silvicultural unit after HCP/NCCP commencement

The same rules apply for subsequent entries into a silvicultural unit. If there is not the requisite number of snags, wildlife trees, or marked recruitment trees *on average* per acre, MRC will once again need to recruit snags. In this way, we will always address the possibility that trees, designated as snags, wildlife trees, or recruitment trees in an earlier PTHP, may no longer be standing or may not have developed as expected. On subsequent entries into a silvicultural unit, however, we operate under an additional constraint, namely that we must always retain recruitment trees marked during a previous PTHP entry unless (a) there is an alternative tree within the same acre that we conclude will more quickly become a snag or wildlife tree or (b) retaining a snag presents a safety issue for forest workers..

Core areas for northern spotted owls

MRC may designate core areas for northern spotted owls after marking wildlife trees for retention and prior to harvest because a northern spotted owl could locate to a PTHP area after MRC has finished marking wildlife trees and snags. In these instances, the RPF will use professional judgment to estimate whether removing the core area from wildlife tree calculations would significantly lower the number of wildlife trees retained. If so, the RPF will mark additional trees for retention outside of the core area. Our intent is always to maintain each designated area (e.g., core area and non-core area) within the PTHP location at or above MRC objectives.

9.2.2.1.2 Downed wood

MRC will only survey for downed wood if we intend to harvest existing downed wood within a silvicultural unit. In harvesting such wood, we will complete a census of all downed wood throughout the silvicultural unit and, if necessary, fell trees to make up for any deficiencies of downed wood in the unit. MRC will not conduct a survey if we are simply removing downed logs that are blocking a roadway. MRC will include downed wood within our timber inventory data (see Appendix U, *Inventory Strategy*, section U.3.2).

9.2.3 Conservation measures

9.2.3.1 Snags and wildlife trees

The following conservation measures refer to, *on average*, 2-3 snags or recruitment trees and 1 wildlife tree or recruitment tree per acre. For clarification, this means 2 snags in general forested areas and 3 snags in Class I and Large Class II AMZs (O§9.2.2-1 and O§9.2.2-2).

	Conservation Measures for Snags and Wildlife Trees within a PTHP
C§9.2.3.1-1	Retain[3] in Class I and Large Class II AMZ a minimum of ▪ 1 hard snag or recruitment tree *on average per acre*[7] that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 2 hard snags or recruitment trees o*n average per acre* that are ≥ 24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall.
C§9.2.3.1-2	Retain in general forested areas a minimum of [8] ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥ 24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall.
C§9.2.3.1-3	Retain, if present, 1 additional hard snag ≥ 16 in. dbh and ≥ 30 ft tall per acre during sanitation/salvage operations; do not retain additional recruitment trees if a hard snag is not present.
C§9.2.3.1-4	Fell snags only when they (a) present safety hazards to workers, (b) create excessive fuel loads, or (c) are part of a sanitation/salvage PTHP or exemption: ▪ **Safety hazards** ▫ If MRC determines after a thorough review that we must cut a very large hard snag (i.e., >36 in. dbh and more than 20 ft tall), we will provide written notification to the wildlife agencies about (a) our intent to fell the tree, (b) our reasons, and (c) other alternatives considered. If we do not receive a response within 5 business days, we will fell the tree. MRC may fell other snags and wildlife trees for safety reasons without obtaining approval of the wildlife agencies; in those instances, we will include the number of felled trees in an annual report (see D.4.2.3). ▫ If a snag which is > 16 in. dbh and > 30 ft tall presents a safety hazard, MRC will attempt to cut the tree at least 4 ft above the ground (always consistent with safe harvest operations) and leave the felled snag in place unless it is blocking a road right-of-way, an existing road, or skid trail. In that case, it will be necessary to move the felled snag but place it near the location where it originally was felled. MRC will notify the wildlife agencies of all such incidences in a yearly compliance report (see D.4.2.3). • **Fuelwood** ▫ If a snag which is < 16 in. dbh and < 30 ft tall presents a safety hazard along a road or landing, a Licensed Timber Operator (LTO) can cut it for fuelwood.

[7] MRC calculated the value by silvicultural unit and then standardized the value per acre.
[8] These areas exclude designated core areas of northern spotted owls, as well as Class I and Large Class II AMZs.

	Conservation Measures for Snags and Wildlife Trees within a PTHP
C§9.2.3.1-5	Do not leave trees harvested within LACMA[9] (at the discretion of the wildlife agencies) to meet the retention goals for downed wood (see O§9.2.2-1 and O§9.2.2-2).
C§9.2.3.1.6	Prevent, as feasible, the loss of snags and wildlife trees during preparation and execution of prescribed burning.
C§9.2.3.1-7	Choose for recruitment those trees with the most characteristics valuable for wildlife (see 9.2.2.1.1). **NOTE** MRC will tally snags, wildlife trees, and recruitment trees within forested areas separately from Class I and Large Class II AMZs and from core areas for northern spotted owls. If MRC cannot meet the objective for snags or wildlife trees, we may choose recruitment trees that also meet the minimum size requirement for retained trees. MRC will paint a “W” on the tree trunk for a snag or wildlife tree, and an “R” for a recruitment tree.
C§9.2.3.1-8	Harvest, in subsequent entries, trees marked with an “R” only if there is a tree within the same acre more likely to recruit to a snag in a shorter time.
C§9.2.3.1-9	Assess snags within a silvicultural unit using only contiguous silvicultural units; exclude Class I and Large Class II AMZs and core areas for northern spotted owls. **NOTE** If a PTHP consists of 6 non-contiguous silvicultural units, MRC will assess each unit separately.
C§9.2.3.1-10	Ensure that no more than 50% of snag recruitment trees for each silvicultural unit are hardwoods.
C§9.2.3.1-11	Permit firewood cutting only in amounts that still allow MRC to meet snag or LWD objectives.
C§9.2.3.1-12	Provide to the wildlife agencies, in an annual report, maps and tables showing the number of old-growth trees, wildlife trees, and recruitment trees within each silvicultural unit (see Appendix D, section D.4.2.1*)*.
C§9.2.3.1-13	Retain all wildlife trees. **NOTE** ▪ MRC will permit the harvest of trees > 24 in. dbh with basal hollows that “heal over” as long as they do not otherwise fall into one of the protection categories. ▪ MRC will permit the harvest of stump sprouts growing over the basal hollows of previously harvested trees as long as this does not diminish the basal hollow characteristics of the original stump. ▪ MRC will permit the harvest of a former raptor-nest tree once the nest is no longer evident as long as the tree does not otherwise fall into one of the protection categories. ▪ MRC will retain trees that support nests with structural deformities (e.g., broken tops and forked tops) whether or not a raptor nest is present. ▪ MRC will obtain approval of the wildlife agencies on alternative conservation measures for protection of the characteristics most valuable to wildlife in a

[9] Lower Alder Creek Management Area (see section 10.3.2.1.1)

	Conservation Measures for Snags and Wildlife Trees within a PTHP
	stand that is exceedingly dense with wildlife trees which, in many cases, appear limited in their actual wildlife value. These alternative conservation measures will not include harvesting old-growth trees. In any case, MRC will retain a minimum of 3 wildlife trees, snags, or recruitment trees per acre.

9.2.3.2 Downed wood

! In preparing a PTHP for LACMA, MRC may not follow conservation measures for downed wood in an effort to reduce potential predators of murrelet nestlings and eggs, such as deer mice and squirrels. In such cases, MRC must first obtain approval from the wildlife agencies that this is an appropriate action.

	Conservation Measures for Downed Wood within a PTHP
C§9.2.3.2-1	Retain the requisite number and size of logs per acre, if harvesting hard downed wood in the stand: ▪ In Class I and Large Class II AMZs and in extended protection areas for northern spotted owls, 6 pieces of downed wood *on average* per acre, each ≥ 16 in. average diameter, ≥ 6 ft long, and derived from at least 3 trees. ▪ In general forested areas, 5 pieces of downed wood *on average* per acre, each ≥ 16 in. average diameter, ≥ 6 ft long, and derived from at least 3 trees.
C§9.2.3.2-2	Do not harvest downed wood embedded in the bed or bank of any watercourse.
C§9.2.3.2-3	Leave downed logs where they fall, if possible; otherwise place them so that they follow the contours of a hillslope, if possible.[10]
C§9.2.3.2-4	Retain all hollow logs and hollow standing trees[11] for future recruitment as downed wood.
C§9.2.3.2-5	Permit cutting of firewood only on roads and landings. **NOTE** This requirement does not apply to commercial harvest of firewood.
C§9.2.3.2-6	Leave non-commercial pieces of downed wood ≥16 in. average diameter and ≥ 6 ft long on the forest floor, if possible.
C§9.2.3.2-7	Return to the forest floor, before completing landing operations, any piece of wood that is > 24 in. average diameter.

[10] This may increase their use by wildlife, especially on steep slopes (Bull et al. 1997).

[11] Evidence that large-diameter trees may have hollow chambers include (1) a broken bole with a “bayonet” top; (2) more than one pileated woodpecker cavity; (3) fruiting bodies of Indian paint fungus; or (4) an old injury or bend along the bole where a new leader formed a trunk many years ago.

9.2.4 Rationale

Snags, downed wood, and wildlife trees are important habitat features for many species of terrestrial vertebrates. The dependency of wildlife species on snags and wildlife trees ranges from incidental to absolute. California Wildlife Habitat Relationships (CWHR) is a database with information on the state's wildlife. According to CWHR, over 90 vertebrate species in Mendocino County prefer or require snags to fulfill a portion of their life-history needs (CDFG 1996e); this includes 2 species of amphibians, 54 birds, and 36 mammals.

In forests managed for timber extraction, the size, condition, abundance, and distribution of snags, cavity trees, and downed wood is reduced or changed by

- Short harvest rotations.
- Elimination of recruitment trees.
- Changes in growing conditions of crop trees.
- Management for optimal growth, e.g., reducing resource competition and shade.
- Management of diseases and insect infestations.

MRC believes continual maintenance and recruitment of snags and wildlife trees, along with the downed wood that results from their decay and from harvest operations, will benefit not only the listed species in the plan area, but also many others.

9.2.4.1 General forested areas

To ensure sufficient snags, wildlife trees, and downed wood in our forest, MRC will retain and, if necessary, recruit wildlife trees and hard snags during timber operations. Even in areas where the number of snags and logs are currently considered on target, retaining wildlife trees as an HCP/NCCP conservation measure should ensure that future stands and watersheds will remain on target as well.

Based on our last timber cruises in 2007 and 2008, there are approximately 0.36 snags per acre in the plan area; similarly, with regard to downed wood, the plan area has, on average, 6.4 logs per acre (see Appendix O, *Snags and Downed Wood*). Extrapolating from this inventory data, MRC has set an objective for general forested areas to retain *on average* per acre *2* snags and 1 wildlife tree or an equivalent combination of snags, wildlife trees, and recruitment trees. We have chosen to frame the objective for snags as an *average per acre* over a silvicultural unit because snags and other wildlife trees are common in some areas while scarce in others. Most silvicultural units are at least 30 ac; this allows for areas with clumps of snags and other areas with few or none. MRC is confident that meeting these objectives for snags will easily provide for the habitat needs of the northern spotted owl, as well as other covered species. Moreover, recruiting and retaining wildlife trees and snags provides over time the requisite downed wood for the forest biota.

9.2.4.2 Class I and Large Class II AMZ

MRC recognizes that Class I and Large Class II AMZs are likely to have greater need for snags and downed logs. Rivers, streams, and adjacent land are particularly valuable habitats for wildlife. Terrestrial wildlife needs access to rivers and streams for drinking water and sometimes for hunting; many animals spend their lives both in water and on land. Additionally, since AMZs are less susceptible to destructive fires, they have more snags and downed wood than the general forested areas. Therefore, MRC increased the goal for retention and recruitment in these areas to *on average* 4 snags and wildlife trees per acre and *on average* 6 pieces of downed wood per acre. Given our AMZ management standards including retention of the largest trees, MRC believes we will meet and generally exceed these goals.

9.2.4.3 Stump requirement

To ensure personnel safety or reduce fuel hazards, MRC may need to cut snags and wildlife trees. In doing so, we will retain as tall a stump as is consistent with safe operations; the minimum height of the stump will be 4 ft, if consistent with safe harvest operations. As of 2011, the average stump for felled trees is 1 to 1.5 ft high. Generally, a higher stump provides potential den sites for mesocarnivores and microhabitat for small mammals. These stumps will also eventually decay and provide food sources for small mammals as well.

9.2.4.4 Cavity size and height of wildlife trees and snags

Primary excavators, like northern flickers and pileated woodpeckers, create large nesting cavities. Other species, such as swallows and small owls, do not create cavities but use smaller cavities created by flickers and pileated woodpeckers. According to Bull (1987) the average nest cavity of a pileated woodpecker is 3.5 x 4.7 in. Erskine and McLaren (1972) reported the average nest cavity of a northern flicker is 2.5 x 2.8 in. In proposing a maximum cavity of 3 in. as a wildlife tree attribute, MRC is including the smaller cavities used by the smaller species.

Existing cavities are a requisite for all secondary cavity-nesters as well, including western screech owls, northern pygmy owls, northern saw-whet owls, purple martins, and violet green swallows. Generally, these species select cavities well above ground height to avoid predation. For instance, the western screech owl nests in cavities ranging from 15-60 ft high (Zeiner et al. 1990b, 324) while the northern saw-whet owl nests in cavities ranging from 5-50 ft high (Zeiner et al. 1990b, 342). Cavity size must be large enough for the birds to enter and exit the cavity with relative ease. While many nest box plans for smaller birds call for holes 1-2 in. in diameter, MRC believes a 3 in. diameter will provide for these species in addition to the larger species that will use the holes on the landscape, such as western screech owls.

9.2.4.5 Density and size of wildlife trees and snags

Snags and wildlife trees are important landscape features for wildlife. They provide nesting cavities and platforms, roosting habitat for bats, food in the form of invertebrates and mast from hardwood trees, as well as protection from predators. A landscape manager must tackle the difficult task of assigning a set number of large trees to be retained for wildlife in order to balance ecological and economical demands. MRC determined wildlife tree requirements for retention, density, and height after careful review of the available literature and discussions with the wildlife agencies.

9.2.4.6 Density and size of downed wood

Downed wood is a key habitat element for multiple taxa of wildlife. It provides shelter, food, cover, and travel pathways for smaller animals. As it decomposes, downed wood provides food and cover for multiple wildlife species. Our forest landscape contains a large amount of downed wood from previous harvest operations. We determined our retention standards by density and average diameter after careful review of the available literature and discussions with the wildlife agencies.

9.2.4.7 Justification in scientific literature

9.2.4.7.1 Snags

Snags are essential structural components of a healthy forest. They provide substrate for saprophytic fungi and invertebrates that not only supply prey for many birds and mammals, but also facilitate decomposition. When a snag falls, it continues to support many fungus, plant, and wildlife species (WDFW 1995). Lack of standing dead trees can be a limiting factor for some cavity-dependent wildlife populations; the density of cavity-nesting birds is closely associated with snag density (Thomas et al. 1979, Zarnowitz and Manuwal 1985, Schreiber and deCalesta 1992). Snags also provide roost sites for many species, foraging perches, and sunning sites.

Wildlife species dependent on snags can be divided into (1) those that nest or den on the branches or broken tops of snags, and (2) those that inhabit interior hollows or cavities. The great blue heron, osprey, and bald eagle are examples of bird species that sometimes nest in the branches or broken tops of snags; they also make use of green trees with dead tops. Woodpeckers are the primary hole-nesters, or birds that excavate their own nest holes. In northwestern California, the most abundant nesting woodpecker is the northern flicker, followed by the downy, hairy, and pileated woodpeckers (Harris 1993). These species nest mostly in cavities within dead trees as well as in live trees with dead limbs or tops (Shuford 1993). Pileated woodpeckers use large snags for both roosting and nesting. Secondary cavity-nesting species depend on woodpecker holes or other natural cavities for nesting and roosting. Examples in northwestern California include the wood duck (Bellrose 1980) and purple martin (Shuford 1993). Bats use cavities in snags for maternity and communal roosts (Christy and West 1993). Vaux's swifts build nests inside large, hollow trees (Bull and Cooper 1991, Sterling and Paton 1996). Female Pacific fishers choose living or dead standing trees that have cavities with relatively small openings as den sites in which to raise their young (Powell and Zielinski 1994, Aubry 1996, Golightly 1997); both sexes use hollows in live trees or snags as resting sites (Powell and Zielinski 1994).

Other species, such as the northern spotted owl, can nest in snag cavities, but do not appear to require snags for nesting because they frequently nest in live trees. High-quality habitat for these species often contains a high proportion of snags, such as those found in old growth or “decadent” forests, along with a high incidence of large trees with large cavities or broken tops. In addition, high-quality habitat includes a forest floor with heavy accumulations of downed logs, dead limbs, and other downed wood (Thomas et al. 1990).

9.2.4.7.2 Downed wood

Wood on the forest floor is a critical habitat component for many wildlife species. As with snags, lack of downed wood of sufficient sizes or specific decay stages may be a limiting factor for some species of wildlife. Several species of terrestrial amphibians are more common in areas with more downed wood. Downed wood provides a feeding site for many animals, including small rodents, American martens, Pacific fishers, and various invertebrates. Downed wood also provides a moist growing substrate for mosses and lichens. Of the 320 species of fungi associated with redwood forest, 77 are dependent on downed wood as a growing substrate (Noss 2000, 64-68).

On old-growth forest floors, downed wood is usually a dominant structural feature with downed logs "strewn about like titanic pickup sticks" (Norse 1990, 50). The downed logs in old-growth forests are not only large on average, but are also present in a variety of sizes and decay classes (Norse 1990). In general, old-growth forests tend to have a greater volume of large downed wood than do second-growth forests (Franklin et al. 1981, Carey and Johnson 1995).

Size, character, abundance, and distribution of large downed wood in managed forests depends on many factors, including tree species; growing conditions; fire, flood, and windstorm frequency; distribution and abundance of snags; timber harvesting and salvage; and harvesting for fuel wood. Timber harvesting can significantly affect the distribution and abundance of large downed wood on the forest floor of managed stands. Untreated logging debris or slash (branches, foliage tops, and un-merchantable wood) can provide refuge and cover for some wildlife, although excessive slash can form a barrier to animal movement. However, these sources are too limited to provide for all wildlife. Moreover, if retained, logging debris and slash have a short longevity. Due to increased fire hazards and the need for reforestation, logging debris and slash are sometimes removed by prescribed burning. In recent years, large downed wood on the forest floor has been further depleted in many U.S. forests; it has become economical for timber operators to salvage downed logs left behind from earlier timber operations. Reductions in organic matter can have important consequences for chemical, biological, and physical properties of soil (Jurgensen et al. 1997) and for surface erosion rate. Removal of a large percentage of coarse downed wood and use of prescribed burning after timber operations can result in loss of soil nitrogen (Jurgensen et al. 1997). Finally, logging equipment can inadvertently crush downed logs; crushed logs do not provide the same wildlife value as intact logs (McCarthy and Bailey 1994).

Populations of many forest species, such as the ensatina (salamander), western red-backed vole, and Pacific fisher, can be limited by the reduction or absence of large downed wood. Large downed logs and scattered debris piles offer cover for larger mammals and birds (Bartels et al. 1985, Beschta et al. 1995). For example, downed wood on the forest floor provides natal dens and resting sites for fishers. Large downed wood serves as a food resource for wildlife species that forage on fungus and invertebrates. When LWD ultimately decays, it contributes nutrients critical to the health of a forest.

Even the spaces between loose bark of freshly downed logs and stumps are used for cover by many invertebrate and small vertebrate species (Maser et al. 1979, Schowalter et al. 1997). Downed wood is rapidly colonized by insects, especially beetles (Norse 1990). Beetles provide an important function in primary decay processes because they not only create tunnels with corridors for earthworms, carpenter ants, termites, millipedes, mites, spiders, amphibians, and plant roots, but also carry mutualistic fungi that further the decomposition process (Bartels et al. 1985, Hendrix 1996). Many amphibian species depend on decayed logs for cover and food (Corn and Bury 1991a, Beschta et al. 1995).

When downed logs begin to decompose, small mammals, such as the Pacific shrew, Trowbridge's shrew, and red-backed voles create burrows in interior portions of a log. The under portions of both freshly downed and decomposed logs also provide small mammal cover (Norse 1990). At JDSF, Fitts and Northen (1991) found that Sonoma chipmunk populations were positively correlated with the presence of high levels of large downed wood. Maintenance of rodent populations benefits predators, such as the northern spotted owl.

Small mammals burrowing inside and beneath downed wood enhance habitat for fungi, which in turn provides food for small mammals (Maser et al. 1979). In moist soil underneath downed logs, hypogeous (underground-fruiting) fungi or truffles are an important food source for many rodents, squirrels, and chipmunks (Maser et al. 1979, Fogel 1995, Mills 1995). Fungus-feeding rodents distribute fungal mycorrhizae across the forest floor through spores in their feces (Maser et al. 1978, Levy 1997). This process can be important in re-establishing fungus in areas that have been clear-cut or burned; rodent populations return more quickly to sites rich in downed wood.

Logs on the forest floor are important for nutrient and water turnover and storage. Leaves, other debris, and soils often accumulate on logs and are used by other organisms. Bacteria decompose a fallen log by feeding on it and releasing nitrogen. Mycorrhizal fungi also grow into the log from seedlings and can transfer nutrients and moisture to the plant. Although the specifics of nutrient cycling from downed wood are not understood, it is clear that downed wood plays an important role in forest productivity. Mycorrhizal fungi have a symbiotic relationship with the roots of conifers. Fungus enhances a conifer's uptake of nutrients and water from the soil; the tree nourishes the fungus with sugars and amino acids. In addition, decomposing downed wood and leaf litter contribute phosphorous and nitrogen to the growth of new vegetation (Bartels et al. 1985). According to Jurgensen et al. (1997), organic components of soil contributed in part by downed wood are important factors in forest health and productivity.

Downed logs are also important reservoirs of moisture during dry months. Downed wood helps create favorable microsites for tree seed germination and seedling establishment; large pieces can serve as "nurse logs" for tree seedlings (Kuuluvainen 1994, Norse 1990). Large downed wood provides moist refuges for wildlife, such as amphibians, during dry periods and especially during fires. Larger debris has a greater ratio of volume to surface area, and thus a greater likelihood of maintaining moist interior conditions.

9.3 Hardwoods

9.3.1 Overview

Hardwoods, in particular tanoak, are aggressive competitors in early seral stages of redwood and Douglas-fir forests in Mendocino and Sonoma counties. The Regional Committee on Hardwood Retention (1996) calculated that hardwood contribution to standing volume increased by a factor of 3 from 1953 to 1994 due to fire suppression and heavy clearcutting without post-harvest control treatments. Due to an apparent overabundance of hardwoods, MRC needs to control them at both the stand and landscape level.

While hardwoods are not the main focus of this plan, they are important to the ecology of MRC forests and many wildlife species, like the northern spotted owl and pileated woodpecker. One of our main goals is to restore an ecological and economical balance between conifer and hardwood species on our land. The first challenge is assessing the “natural” proportion of hardwoods in conifer stands. The second is deciding which stands should be retained as complete hardwood stands.

We know that hardwoods are a natural component of the understory of mixed redwood and Douglas-fir forests; however, there is limited data on the natural density of hardwoods within these forests. Current data is from small patches of old-growth stands that have not experienced wildfires in 40-60 years. A recent study by Giusti (2007) in an old-growth state reserve in Mendocino County found that hardwoods made up 80% of the trees less than 10 in. dbh. According to the study, stocking of tanoaks greater than 10 in. dbh exceeded 25 ft^2/ac. Giusti also reports in the study that tanoaks dominate the smaller size classes (2-10 in. dbh) but this dominance of tanoak stems is inversely proportional to size class. The larger the size class, the fewer the tanoaks. This seems to indicate that hardwoods are a heavy understory component even in old-growth stands; but, again, the reserve studied by Giusti has not experienced a fire event in at least 50 years.

In northwestern California, Bingham and Sawyer (1992) found hardwoods and conifers were most dense in young stands (40-100 years) and least dense in old stands (more than 200 years). The study showed 131 hardwoods to 41 conifers per acre for young stands and 82 hardwoods to 24 conifers per acre for old stands. Associated with the decreased density from young to old stands, both hardwood and conifer average diameters increased. Among hardwoods, dbh increased from 12 to 15 in.; among conifers, from 14 to 38 in. Using average density and diameter, the study concluded that the hardwood basal area of the old stands approximated 50 ft^2/acre or just over 20% of the total area.

While MRC definitely wants to retain oak-woodlands, true oak stands, and oak stands that are a result of natural processes rather than intensive harvest, we do not want to retain all tanoak-dominated stands. There are very few guidelines for deciding the amount of hardwood stands to retain. One researcher (Wimberly 2002) ran a spatial simulation of Oregon Coast Range forests, simulating fire regimes 1000 years prior to European settlement. He examined possible scenarios for distribution of various successional stages. His model indicated that old-growth forests generally occupied at least 40% of the landscape while young forest ranged from 15-31% of the landscape with a median of 21%.

Rather than modeling our landscape with fire regimes, we are assessing our hardwood-dominated stands to distinguish stands with native hardwoods and no history of conifer harvest from stands that are the direct result of intense conifer harvest. MRC will not manage for timber production the stands with native hardwoods and no history of conifer harvest. Our forests will always contain a certain amount of tanoak that we will remove or control on an ongoing basis. However, we will also protect some tanoak for wildlife species; for example, we will retain most hardwoods in the AMZs and in core areas for northern spotted owls. In addition, we will retain a small proportion of hardwoods in every harvest unit.

Upon review of an initial draft of our HCP/NCCP, a Science Panel, convened as part of the NCCP process, expressed concerns about our restoration of conifer forests:

> In the MRC presentation to our team, a plan for conversion of a portion of the broadleaf upland forest to conifer forest was discussed…Conversion to conifer forest could endanger some populations of sensitive species (Noss et al. 2003, 27).

MRC believes that the Science Panel did not fully understand our intended goal. Within the plan area, we are proposing (a) to attain an ecological and economical balance of conifers-to-hardwoods; (b) to leave natural oak stands unmanaged; and (c) to retain some tanoak stands as representative samples of early successional stands.

Our conservation measures protect the most important hardwoods; retain a certain basal area of hardwoods in all stands; retain stands that have naturally progressed to hardwood-domination; and retain some hardwood stands as representative of the early seral condition of a conifer-dominated stand type. MRC recognizes that the “natural” hardwood component of any stand will vary according to site conditions; for instance, Site Class I and Site Class II are apt to grow more conifers and fewer hardwoods. However, maintaining and recruiting hardwoods in the plan area will not only enhance structural diversity of the forest but encourage greater diversity of wildlife species. We have designated 15 ft^2/acre of hardwood basal area for retention post-harvest. This number, we believe, reflects an appropriate level of hardwood retention given site conditions on our land and based on literature review, site capability, and internal discussions. Furthermore, we have designed an adaptive management strategy (M§13.9.1.4-6) that assesses how this hardwood retention affects spotted owl productivity.

9.3.1.1 Hardwood control

After timber harvests in north coastal California, some hardwood species, such as tanoak, often out-compete seedlings of coniferous species (Holland and Keil 1995). Conifers may not regain dominance in the canopy for more than 100 years. Historically, landowners have removed conifers during commercial timber harvest while retaining hardwoods. This practice results in overstocking of hardwoods relative to conifers. In general, MRC will remove or control hardwoods where they impede the regeneration or growth of conifers.

MRC does not have specific conservation measures for hardwood control; however, we do have certain operational guidelines. MRC will

- Determine potential areas for hardwood control from (1) recent harvests, including but not limited to variable retention, past clearcuts, seed tree and shelterwood removal, transition, and rehabilitation; (2) conifer sites with excessive hardwood (generally tanoak) competition; and (3) sites with a high probability of conifer release.
- Prohibit elimination of all tanoak stands on covered lands.
- Prevent, where feasible, the expansion of eucalyptus, an invasive non-native tree, and attempt to eradicate it.

9.3.1.2 Hardwood classifications

MRC initially estimated the number of our hardwood acres from aerial photos. Prior to any harvest, we will complete an on-the-ground assessment of each hardwood-dominated stand and assign them to one of 3 classes:

- Class I stands are dominated by native hardwoods (tanoak, madrone, true oak, etc.) and have never been managed for conifer timber production.
- Class II stands are dominated by native hardwoods and may have had some conifer harvest, although their suitability for conifer restoration is unknown.
- Class III stands are dominated by native hardwoods only because of past management and are clearly suitable for conifer restoration.

The significance of these classifications for MRC timber management and conservation is as follows:

- MRC will not harvest in Class I stands.
- MRC may harvest in Class II stands. Prior to any harvest in a Class II stand, however, we will assess the feasibility of restoring the stand for conifer timber production. If feasible, we will re-classify the Class II stand as a Class III stand. If not feasible, we will re-classify the Class II stand as a Class I stand.
- MRC may harvest Class III stands and restore them to conifer dominance.

The HCP/NCCP Atlas (MAPS 4A-C) shows Class I, Class II, and Class III hardwood stands.

9.3.1.3 Representative samples of early seral hardwood stands

In addition to Class I, Class II, and Class III stands, MRC has designated a portion of our hardwood-dominated stands as representative samples of the early seral condition of a conifer-dominated stand type. These areas represent the current conditions of hardwood-dominated stands throughout the plan area. As MRC restores the plan area to conifer dominance, these representative hardwood areas will retain hardwood dominance, much as they do now. Hardwoods provide unique habitat for terrestrial wildlife and plants. MRC may only manage these stands to maintain the relative proportion of hardwoods to conifers. The HCP/NCCP Atlas (MAPS 4A-C) shows representative sample areas of early seral hardwood stands.

9.3.2 Goals and objectives

Goals and Objectives for Hardwoods	
Goals	
G§9.3.2-1	Restore stands that historically were dominated by conifers.
G§9.3.2-2	Exclude harvests from Class I hardwood stands.
G§9.3.2-3	Maintain patches dominated by early seral hardwoods in variable retention units.
G§9.3.2-4	Provide representative samples of early seral hardwood stands throughout the plan area.
Objectives	
O§9.3.2-1	Retain, after harvest**,** 15 ft^2/ac of hardwoods > 6 in. dbh, if such hardwoods comprised at least 15 ft^2/ac of the total basal area of a silvicultural unit prior to harvest.
O§9.3.2-2	Prohibit treatment of hardwoods > 6 in. dbh if such hardwoods comprise less than 15 ft^2/ac of the total basal area of a silvicultural unit prior to harvest.
O§9.3.2-3	Maintain true oak stands.
O§9.3.2-4	Retain hardwood components of riparian stands (AMZs) unless the riparian stand has been identified for conversion to conifer.
O§9.3.2-5	Retain hardwood areas within variable retention units.
O§9.3.2-6	Harvest in representative sample areas only to maintain the relative proportion of hardwoods to conifers.
O§9.3.2-7	Designate 1487 ac as representative sample areas for early seral hardwood stands (Appendix B, *HCP/NCCP Atlas*, MAPS 4A-C).

9.3.3 Conservation measures

9.3.3.1 Hardwood retention in AMZs

The hardwood retention guidelines refer to all hardwood species except eucalyptus. MRC will control eucalyptus, where possible, through vegetation management.

	Conservation Measures for Hardwood Retention in AMZs
C§9.3.3.1-1	Do not manage hardwoods in riparian stands (AMZs) unless this management enhances riparian or instream habitats; establishes cable corridors for harvesting operations; or creates safer working conditions.
C§9.3.3.1-2	Retain the boles of felled hardwoods to provide instream and terrestrial woody debris.

9.3.3.2 Hardwood retention in general areas

	Conservation Measures for Hardwood Retention General Areas
C§9.3.3.2-1	Retain, after harvest, 15 ft^2/ac of hardwoods > 6 in. dbh, if such hardwoods comprised at least 15 ft^2/ac of the total basal area of a silvicultural unit prior to harvest.
C§9.3.3.2-2	Prohibit treatment of hardwoods > 6 in. dbh if they comprise < 15 ft^2/ac basal area in a silvicultural unit prior to harvest.
C§9.3.3.2-3	Retain all hardwood trees ≥ 24 in. dbh when these hardwoods constitute ≤ 20% of the basal area of the harvest unit, unless it is necessary to remove them for safety, road right-of-way, or yarding corridors.
C§9.3.3.2-4	Retain clusters of mast-producing hardwoods.
C§9.3.3.2-5	Retain true oaks and madrones > 18 in. dbh unless it is necessary to remove them for safety, road right-of-way, or yarding corridors.
C§9.3.3.2-6	Leave true oaks and madrones > 18 in. dbh—felled for safety, road right-of-way, or yarding corridors—on the ground as downed wood, unless it is necessary to move them to clear a road or road right-a-way.
C§9.3.3.2-7	Retain trees, regardless of size, that show evidence of significant wildlife use (e.g., whitewash, acorn granaries of woodpeckers, nests of raptors or other birds) and that provide valuable structural complexity or decay elements (e.g., cavities, broken or dead tops, or loose bark).
C§9.3.3.2-8	Retain hardwoods, when possible, in clumps that include a variety of size classes and that surround large individual trees or those with significant wildlife value.
C§9.3.3.2-9	Place priority on retaining hardwood clumps where they enhance connectivity between wildlife habitats, such as in AMZs, atop ridgelines, and in low spots between two large drainages.
C§9.3.3.2-10	Retain aggregate hardwood patches in variable retention units for the life of the HCP/NCCP.[12]
C§9.3.3.2-11	Harvest oak woodlands and true oak forests only to remove invasive conifers.
C§9.3.3.2-12	Exclude Class I hardwood stands (Appendix B, *HCP/NCCP Atlas*, MAPS 4A-C) from harvesting. **NOTE** MRC will not harvest native hardwood stands that we type as Class I (288 ac); we may harvest Class II hardwood stands (333 ac) if we re-classify them as Class III in future on-the-ground assessments.

[12] In the process of preparing a variable retention PTHP, an RPF will decide how to meet the minimum retention requirements, i.e., through either dispersed or aggregate retention. If the RPF selects aggregate retention (targeted, in this case, at hardwoods), MRC will retain all aggregate hardwood patches within the silvicultural unit throughout the term of our HCP/NCCP.

9.3.3.3 Representative sample areas

	Conservation Measures for Representative Sample Areas
C§9.3.3.3-1	Maintain a mixed-age stand of hardwoods, representative of an early seral hardwood stand.
C§9.3.3.3-2	Maintain the relative proportion of conifers to hardwoods.
C§9.3.3.3-3	Meet the minimum stocking standards of the Timber Management Plan (TMP).

9.3.4 Rationale

9.3.4.1 Hardwood control and retention

Hardwood species in the assessment area include Pacific madrone, California black oak, live oak, tanoak, California bay laurel, chinquapin, red alder, bigleaf maple, willow, Oregon ash, white oak, and eucalyptus (a non-native species). Many hardwood tree species in the assessment area occur as components of coniferous forests. One of these species, tanoak, has become overabundant in many stands and is out-competing redwood and Douglas fir. This pattern of tanoak overabundance has been observed throughout the redwood region, with the Regional Committee on Hardwood Retention[13] stating that,

> in 1953, hardwoods accounted for approximately 10% of all standing volume…hardwood volume increased dramatically because hardwood logging and mortality were largely incidental…by 1968, hardwoods accounted for 15% of all standing volume in Mendocino and Sonoma counties. This increased to 33 percent by 1994. (Regional Committee on Hardwood Retention 1996)

The dominance of tanoak in the plan area has 2 causes: (1) heavy clearcutting of redwood stands with no post-harvest treatment to reduce tanoak; and (2) fire suppression resulting in longer fire-free intervals with higher intensity fires. These practices have caused a dramatic increase in the proportion of tanoak in the redwood region. Tanoak is a long-lived shade-tolerant species that is able to survive in the understory of conifer stands, sprout vigorously when injured, and quickly dominate vegetation when an intense disturbance occurs, such as clearcut harvest or catastrophic fire (Tappeiner et al. 1990). Heavy logging with little or no post-harvest treatment of tanoak was often conducted in the redwood region; this allowed tanoak to dominate many heavily harvested stands. The pre-settlement interval of fires in the redwood region ranged from 6-20 years on coastal and inland sites; fire frequency was related to site-specific patterns rather than inland distance (Brown and Baxter 2003). Typically, pre-settlement fires were low intensity surface fires that opened stands by clearing understory species and shrubs, such as tanoak and huckleberry (Brown and Baxter 2003). These fires left the redwood overstory but cleared the tanoak understory. According to Mayer and Laudenslayer (1988) the climax stage of redwood occurs when redwoods and Douglas fir dominate the overstory. In drier sites hardwoods may be dominant or co-dominant in mid-seral stages but will eventually be over-topped and dominated by redwoods or Douglas fir.

[13] The Integrated Hardwood Range Management Program (IHRMP) was established in 1986 to ensure sustainability of California's 10,000,000 ac of hardwood rangelands. The Regional Committee on Hardwood Retention was formed in 1996 to assess the ecological role of hardwood species in the timberlands of the California north coast and develop guidelines for retaining and increasing hardwood acreage.

The "natural" proportion of tanoaks that would occur in mature redwood and Douglas-fir stands is unknown. MRC believes it is close to 15 ft^2/ac based on site class, topography, and moisture conditions. Following disturbance, hardwoods can dominate stand development during early stages of succession. In order to retain examples of this successional stage on other areas of the landscape, MRC will maintain aggregate retention patches in variable retention units specifically for hardwoods. Over the course of our HCP/NCCP term, MRC estimates this will result in approximately 2900 ac of additional hardwood retention.[14] In the plan area, hardwoods tend to dominate (a) on south-facing slopes, (b) in areas where soils are shallow, and (c) on or near a ridge top (Cafferata and Yee 1991). True oak woodlands comprise approximately 1084 ac of the plan area; we will not harvest them except to enhance the woodlands by removing invasive conifers. Alder, maples, and willows are generally restricted to riparian areas. MRC will not rehabilitate deciduous riparian stands (see section 3.4.3.6). Moreover, we will retain 1487 ac of hardwood representative sample areas. These sample areas range in size from 1 ac to upwards of 20 ac. They occur from the southern portion of the plan area to the northern—from the Garcia forest to the Rockport forest. Given this coverage, they should persist as a unique vegetation type throughout the term of our HCP/NCCP.

9.3.4.2 Classification of native hardwood stands

In 2006, during the initial typing of stands in the plan area, we identified approximately 4431 ac of mixed hardwood stands. At least 70% of the species in these stands were hardwoods. Many of these hardwood-dominated stands were created by past harvest practices and burning. Others occurred as the result of environmental conditions, like soil type and slope aspect. To capture these distinctions in hardwood stands, MRC created 3 classifications—Class I, Class II, and Class III (see 9.3.1.2). In many cases, we could easily identify hardwood stands from aerial photos as Class I because either there was no indication of previous harvest or surrounding forest types indicated poor soil conditions. Likewise, we could identify stands as Class III from the presence of old skid trails and yarding corridors or from surrounding conifer stands. Some hardwood stands, however, were difficult to classify. We designated these as Class II to reflect our uncertainty about the aerial typing. In the case of Class I and Class III stands, we made several field trips to ground-truth our initial judgments. These trips generally confirmed that our aerial classifications were accurate. However, since the majority of our stands (including Class I and Class III) were not ground-truthed, we may change classifications after field verification.

9.3.4.3 Importance of hardwoods for wildlife

In order to maintain and restore biodiversity and the integrity of natural communities in the plan area, it is important that we consider hardwoods. Hardwood stands and hardwood inclusions in predominantly coniferous stands produce valuable cover as well as reproductive and foraging habitat for a variety of wildlife species. The acorn and berry crops of several hardwood species provide important food for many bird and mammal species. A variety of insects feed on hardwoods; birds and mammals, in turn, eat the insects. MRC will afford special protection to madrone, chinquapin, and alder because they are important to wildlife and generally do not out-compete conifers in the plan area. Tanoaks are not true oaks, but still provide wildlife habitat.

Large hardwoods, such as those specified for retention, can to some degree maintain dense canopy closure and large average tree size in a stand; this helps to maintain connectivity of mature or late-successional forest stands. Hardwoods in the plan area with

[14] This is an estimate based on the landscape planning model. We predict approximately 58,000 ac of hardwood-dominated forest will receive variable retention silviculture. Approximately 10% of this acreage will be retained in aggregate (5800 ac), half of which will have hardwood patches.

a dbh of 24 in. or more represent mature trees that likely provide superior wildlife habitat (RCHR 1996). Especially important to wildlife are hardwoods with cavities (Giusti and Tinnin 1993), hardwood snags (Chambers et al. 1997), and hardwoods situated near streams and other surface water. MRC will generally protect individual large hardwoods and hardwoods with large cavities as wildlife trees. Hardwoods tend to develop larger and more complex cavities than similarly sized conifers (RCHR 1996). Retaining groups of hardwoods in a post-harvest stand is preferable to retaining individual trees. Groups of trees are less likely to be affected by windthrow and more likely to provide suitable microclimate and habitat structure, especially for small mammals. They can also enhance habitat connectivity across the landscape.

Red alders are an important hardwood component adjacent to watercourses in the plan area. Unlike most tree species, alders are able to fix their own nitrogen due to the presence of special root nodules containing nitrogen-fixing symbionts (Schoenherr 1992). In northwestern California, riparian areas consisting of alders and willows are heavily used by migratory land birds and provide potential nesting habitat for yellow warblers and yellow-breasted chats (Harris 1993). It is a common forestry practice to remove alders to encourage growth of conifers; the intent is either to increase the amount of valuable timber or increase recruitment of large woody debris and streamside shade levels. However, Cole et al. (1997) determined in a study conducted in the Oregon coast range that uncut red alder stands supported higher populations of red-legged frogs and other amphibians than Douglas-fir stands. They suggested that prescriptions for type conversion should incorporate plans to retain alders adjacent to streams.

Dead hardwoods can be as important to ecological diversity as live hardwoods. Snags are critical to many species, such as the acorn woodpecker. In Douglas-fir forest, both timber harvesting and natural successional processes often eventually result in high tanoak mortality from shading by conifers (Barbour and Major 1977). This mortality can benefit wildlife by recruiting substantial quantities of downed wood. Downed wood on the forest floor is used by many oak woodland denizens, including the California quail, which often nests adjacent to downed logs.

Although few if any wildlife species are completely dependent on mixed coniferous forest, this natural community supports a high diversity of amphibians, reptiles, birds, and mammals (Mayer and Laudenslayer 1988). The acorn crops of oaks and chinquapin, as well as the berries of the madrone, provide an important food resource for many bird and mammal species (Hagar 1960, Keator 1994, Pavlik et al. 1991, Diller 1996). Hardwoods in California support a large guild[15] of insects—up to 5000 species, such as true bugs, moths and butterflies, beetles, and gall wasps (Pavlik et al. 1991). Many edible fungus species are also associated with hardwoods (Arora 1986).

Hardwoods are important for many amphibians and reptiles. Oaks play a role for the arboreal salamander, for example, which often uses cavities in oaks for estivation and laying eggs; in addition, they choose trunks and branches of oaks for feeding (Pavlik et al. 1991). When appropriate aquatic habitat is available nearby, other amphibians and reptiles in a mixed hardwood-conifer forest might include the southern torrent salamander (Welsh et al. 1992, Welsh and Lind 1996), northern red-legged frog, foothill yellow-legged frog (Zeiner et al. 1988), coastal tailed frog (Diller and Wallace 1999), and western pond turtle (Reese 1996).

[15] A guild is a group of organisms or species that exhibit similar habitat requirements and that respond in similar ways to changes in their environment.

Many species of thrushes, flycatchers, vireos, and warblers depend on California's oaks and other hardwoods (Pavlik et al. 1991). Tanoak stands receive considerable bird use in the spring and summer, primarily by insect-gleaning canopy feeders (RCHR 1996). During early winter, birds that feed on acorns and madrone seeds are more prevalent (RCHR 1996). The bird species most closely associated with oaks is the acorn woodpecker, because it relies heavily on acorns for food (Shuford 1993). Pacific madrone berries are an important dietary element for several bird species (RCHR 1996). Studies indicate that in forests adjacent to the plan area many bird species are associated with hardwood inclusions in Douglas-fir forests, including Neotropical migrants, such as the olive-sided flycatcher, warbling vireo, and black-headed grosbeak (Kitchen 1992). Large, old hardwood trees are particularly valuable for birds because they tend to produce more acorns, provide more diverse structure for foraging, and are most suitable for excavation by cavity-nesting birds (RCHR 1996). Purple martin, Vaux's swifts, and pileated woodpeckers may also use oaks for nesting. The northern spotted owl uses mixed coniferous forests for nesting, roosting, and foraging habitat, depending on the structural stages of the trees. In coastal Mendocino County, Pious (1994) found that 8% of the nests on Louisiana-Pacific property were in tanoaks. Of the 24 northern spotted owl nests recorded in Jackson State Demonstration Forest, immediately adjacent to the plan area, 2 were located in tanoaks and 1 in a chinquapin (CDFG 1997c).

Bear Track on MRC Land

Bear from Hidden Camera MRC Land, October 2004

Mammals also depend on hardwoods in California's north coast region. The dusky-footed woodrat, a primary prey species of the northern spotted owl, feeds on foliage of the tanoak (Tevis 1956, as cited in Fitts and Northen 1991). In forests adjacent to the plan area, the abundance of the dusky-footed woodrat is loosely correlated with the density and abundance of tanoaks (Fitts and Northen 1991); this species requires 15 to 30-ft wide brushy clumps of hardwoods that typically occur in early successional stands of tanoak (RCHR 1996). Black-tailed deer and black bears feed extensively on acorns (Weckerly 1993, Schmidt and Gilbert 1978). Deer may be dependent on acorn mast during fall and winter and browse on hardwood foliage during spring and summer. Large, mature tanoaks with a dbh greater than 30 in. produce the largest acorn crops (RCHR 1996). Rare and sensitive mammal species that rely on oaks as cover include the Pacific (Townsend's) western big-eared bat (Kunz and Martin 1982) and the pallid bat (Zeiner et al. 1990a, Nowak 1991).

Pacific fishers often choose cavities in hardwoods as resting sites (Powell and Zielinski 1994). Fishers have been found by researchers to prefer forested habitats with a significant hardwood component (Thomasma et al. 1991, Buskirk and Powell 1994, Self and Kerns 2001). In intensively managed young-growth forests in northwestern California, Klug (1996) found fisher detections to be associated with stations that have a greater basal area of hardwoods. In coniferous forests with a higher hardwood component, there may be more available and diverse prey for the fisher (Self and Kerns 2001); mast-producing hardwoods may also attract more prey for the fisher (Powell and Zielinski 1994). Information on the distribution of larger hardwoods may be important for managing fisher habitat quality and connectivity—at both the home-range and landscape scale (Carroll et al. 1999). A systematic survey completed in the plan area in 2008, however, detected no fishers.

9.3.4.4 Rationale for retention level of hardwoods

The MRC retention standards for hardwoods are built around 5 objectives:

1. Retain, on average, 15 ft^2/ac of hardwood in managed stands.
2. Retain all hardwood stands that would not naturally support conifers.
3. Retain aggregate hardwood patches in variable retention units for the life of our HCP/NCCP.
4. Retain all hardwoods ≥ 24 in. dbh when they constitute < 20% of the basal area of a stand.
5. Retain hardwood representative sample areas to conserve the early seral stage of hardwoods across the plan area.

MRC has worked with the wildlife agencies to develop a hardwood retention policy that meets the needs of our covered species and enhances the value of the forest for other wildlife species as well. There are few guidelines on how many hardwood stands to retain in order to maintain the ecological value of a forest. However, we believe our objectives will provide a forest landscape similar to a mature mixed forest of redwood and Douglas fir with openings for hardwood stands and patches of hardwoods. In our experience, this is the best way to provide habitat for the wildlife species in the plan area.

9.4 Old-growth Trees and Late-seral Forest

9.4.1 Overview

9.4.1.1 Decline in old growth

Old-growth coniferous forest historically covered much of the land west of the Cascade and Sierra Nevada crests. Douglas fir or coast redwood generally dominated these forests. According to most estimates, less than 20% of pre-settlement old growth remains (Spies and Franklin 1988, Morrison 1991, Bolsinger and Waddell 1993, FEMAT 1993, Lehmkuhl et al. 1994). Recent estimates indicate that there is approximately 3-5% of the original old-growth redwood stands remaining (Thornburgh et al. 2000, 229; Fox 1996).

There is very little old growth in the plan area. Future old growth may develop where individual trees surround wildlife trees or existing old growth. Since MRC foresters manage our timberland on harvest rotations of less than 100 years, however, new stands of old growth are unlikely to develop.

9.4.1.2 MRC definitions of old-growth trees and stands

DEFINITION

An individual **old-growth tree** is (1) ≥ 48 in. dbh, if coastal redwood,[16] or ≥ 36 in. dbh, if Douglas fir, and greater than 200 years old; or (2) any tree older than 200 years with a preponderance of old-growth characteristics specific to that species of tree regardless of its dbh; or (3) any tree greater than 200 years old that cannot be replaced in size or ecological function within 80–130 years, regardless of dbh or presence of old-growth characteristics.[17]

A **Type I** old-growth stand is 3 ac or more that has never been logged and that displays old-growth characteristics.[18]

A **Type II** old-growth stand is a previously harvested stand of old growth on a minimum of 3 contiguous acres with an average of 6 old-growth trees per acre.

In the scientific literature, there are a number of other definitions for old-growth forest (Old-Growth Definition Task Group 1986, Morrison 1988, Spies and Franklin 1988). In general, the characteristics of this habitat are (1) a heterogeneous mix of trees of different ages and sizes consisting of both fast and slow growing individuals; (2) abundant shade-tolerant species; (3) numerous large, standing snags and downed logs in various sizes and decay classes; and (4) abundant tree cavities (Franklin et al. 1981, Old-Growth Definition Task Group 1986, Morrison 1988, Spies and Franklin 1988, Norse 1990). The Revised Final Pacific Coast (USA) Regional Forest Stewardship Standard defines 3 specific types of old-growth stands:

> *Type I stands* are those of at least 20 contiguous acres that have never been logged and that display late successional/old-growth characteristics. Stands that have never been logged, but which are smaller than 20 acres, are assessed for their ecological significance, and may also be classified as Type I stands. Areas containing a low density of roads may still be considered Type I stands, provided the roads have not caused significant, negative ecological impacts. Type 2 stands are old unlogged stands smaller than 20 acres that are not classified as Type 1, and other stands of at least 3 contiguous acres that have been logged, but which retain significant late-successional/old growth structure and functions. Type 3 stands are those that have residual old-growth trees and/or other late-successional characteristics, but do not meet the definition of Type 2 stand. (Forest Stewardship Council-US. 2005, 23)

MRC, on the other hand, uses the definitions for Type I and Type II stands given at the beginning of section 9.4.1.2; in our definition, we state that there must be a minimum number of old-growth trees per acre to qualify as Type II. In the case of individual trees rather than stands, we retain all individual old-growth trees with their screen trees. Since old-growth trees clumped in areas less than 3 ac are highly questionable as habitat for any species, we generally define the trees within these areas as individual old-growth trees.

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[16] In areas rated Site Class V or in pygmy transition areas, 32 in. is considered old growth. Site class reflects the potential productivity of forest stands for present and future timber growth. Classes range from I-V. Site Class I is the most productive while Site Class V is the least productive. It is important to note that site classes are only for specific regions. A Site Class I in the mixed conifer region of the Sierra Nevada, for instance, is not likely to have the same growth potential as a Site Class I in the north coast redwood region.

[17] This generally applies to areas with low site classes, such as pygmy forest, pygmy transition forest, serpentine soils, and rocky outcrops.

[18] This is per the FSC-US Forest Management Standard (approved 8 July 2010).

Type I stands best approximate a true old-growth forest. The term "old-growth forest" implies stands large enough to indefinitely sustain the processes (tree growth, death, and replacement) and properties (i.e., interior habitat) of old growth. A single old-growth tree or group of old-growth trees may have some of the habitat values shared by trees in an old-growth forest, but its properties are diminished. Stands containing Type II or residual old-growth trees do not approximate an old-growth forest but still provide multiple characteristics valuable to wildlife. Moreover, individual wildlife trees provide valuable "legacy trees" on the landscape with important habitat elements used more frequently by wildlife than other large trees in the same area (Mazurek and Zielinski 2004).

9.4.1.3 Defining old-growth trees

9.4.1.3.1 Redwood

By MRC definition, old-growth redwood is a tree more than 200 years old that (a) is greater than 48 in. dbh; or (b) cannot be replaced in size or ecological function in 80-130 years; or (c) has a preponderance of the following characteristics:

- Rating in the upper 20% dbh for species on site.
- Deep, furrowed, and fissured bark.
- Fire-resistant bark patterns.
- Flattened or irregular crowns and highly complex structure.
- Highly reiterated crowns (multiple sprouting, replicated growth patterns).
- Large limbs whose diameter exceeds 6-8 in.
- Crown debris accumulation.
- Presence of platforms.
- Cavities or partial snag formation.
- Common or abundant epiphytic vascular plants, complex lichens, and moss.
- Large cat-faces[19] or basal burn cavities.
- Fire scars on lower boles.

9.4.1.3.2 Douglas fir and other conifers

By MRC definition, old-growth Douglas fir and other conifers (aside from redwood) are trees more than 200 years old that (a) are greater than 36 in. dbh; or (b) cannot be replaced in size or ecological function in 80-130 years; or (c) have a preponderance of the following characteristics:

- Rating in the upper 20% dbh for species on site.
- Thick bark, deeply fissured and fire resistant.
- Common or abundant epiphytic vascular plants, complex lichens, moss, and, where crown soils are present, ferns.
- Large lateral limbs whose diameter exceeds 8-10 in.
- Flattened, irregular crowns, with crown thinning and lower limbs showing signs of decay.
- Presence of conks.
- Partial sagging in tops; broken tops.
- Crown debris accumulation.
- Fire scars on lower boles.

[19] A cat-face is a scar or deformed section at the base of a tree where equipment or a falling tree has "skinned" the bark and precipitated healing over-growth or rot.

9.4.1.3.3 Hardwood

By MRC definition, old-growth hardwood is a tree more than 200 years old that (a) cannot be replaced in ecological size or function in 80-130 years or (b) has a preponderance of the following characteristics:

- Rating in the upper 20% dbh for species on site.
- Flattened or irregular crowns, highly complex structure.
- Multiple branching crowns with few large, well-developed limbs.
- Large limbs whose diameter exceeds 4-12 in.
- Crown debris accumulation.
- Presence of platforms.
- Presence of cavities, partial snag formation.
- Crown die-back.
- Cat-faces or basal burn cavities.
- Fire scars on lower boles.

9.4.1.4 Old growth in the plan area

Old growth in the plan area includes un-harvested stands, remnant old-growth components of previously harvested stands, and scattered residual old-growth trees. These trees, both conifers and hardwoods, are remnants of the primary forest that existed prior to Euro-American influence (ca. 1800).

As of 2010, the plan area has an estimated 101 ac (41 ha) of un-harvested old growth considered Type I, 520 ac (210 ha) of Type II old growth, and 12,000 individual old-growth trees.[20] We have included maps of Type I and Type II stands in the *HCP/NCCP Atlas* (MAPS 4A-C); however, we have not confirmed their typing with ground reconnaissance. Additionally, residual old-growth trees may occur singly or in small groups of less than 6 trees; MRC protects these single or clumped trees that, as such, do not qualify as Type I or Type II old growth. Moreover, we assess un-harvested stands less than 20 ac for their ecological significance; in some cases, we may classify these stands as Type I. MRC tracks the size of Type I and Type II stands via site visits and aerial photos (M§13.8.1-5). As MRC comes across individual old-growth trees, we will submit maps of the silvicultural units with the PTHP along with the number of old-growth trees within each silvicultural unit. In addition, we will track the number of old-growth trees within our wildlife tree database.

9.4.2 Goals and objectives

Goals and Objectives for Old Growth	
Goals	
G§9.4.2-1	Preserve and enhance the character and function of old growth and late-successional forests in the plan area.

[20] Our inventory database stores sampled information on tree species and certain tree attributes, e.g., old growth and tree volume. To provide an estimate for the residual old-growth trees scattered across the plan area, an MRC inventory analyst queried our inventory database for old-growth redwood and calculated the average volume of an old-growth redwood tree. The analyst then took the total volume of old-growth redwood divided by the average volume for an old-growth redwood tree to obtain an estimate for the number of old-growth redwood trees. Since we have based this estimate only on sampled data use to drive our landscape computer model, it is very rough.

Goals and Objectives for Old Growth	
Goals	
G§9.4.2-2	Promote the development of mature and late-successional forest.
G§9.4.2-3	Protect the remaining old-growth trees and forest in the plan area.
Objectives	
O§9.4.2-1	Maintain 101 ac of Type I old growth currently identified in the plan area, as well as any new Type I old-growth stands later discovered in the plan area, in order to retain their stand acreage and enhance stand function.
O§9.4.2-2	Maintain 520 ac of Type II stands currently identified in the plan area, as well as any new Type II stands later discovered in the plan area in order to retain their stand acreage and enhance stand function.
O§9.4.2-3	Increase acreage of mature and late successional forest within AMZ and LACMA (see M§13.9.2.2-1, M§13.5.1.2-2, M§13.5.1.1-1, M§13.5.1.1-2).

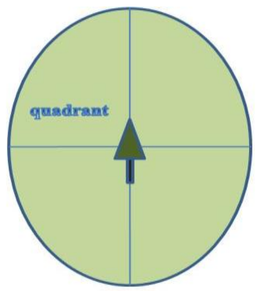
9.4.3 Conservation measures

9.4.3.1 Type I stands

	Conservation Measures for Type I Old Growth
C§9.4.3.1-1	Do not harvest in previously un-harvested stands of old growth.
C§9.4.3.1-2	Pursue conservation easements to permanently protect old-growth stands.
C§9.4.3.1-3	Protect a 150-ft buffer that retains at least 75% of the basal area of conifers in the Type I old-growth stand. **NOTE** A Type I stand with a basal area of 200 ft^2, for example, will have a 150-ft wide buffer with a minimum basal area of 150 ft^2.
C§9.4.3.1-4	Obtain the approval of the wildlife agencies before initiating any burning in old-growth stands.
C§9.4.3.1-5	Cooperate if the wildlife agencies, on their own initiative, decide to re-introduce ecological burns in old-growth stands.

9.4.3.2 Type II stands

	Conservation Measures for Type II Old Growth
C§9.4.3.2-1	Harvest using single-tree selection to maintain and increase mean stand diameter.

	Conservation Measures for Type II Old Growth
C§9.4.3.2-2	Maintain screen trees for old-growth trees and mark them with an "R" so that they are retained during harvest. **DEFINITION** A **screen tree** creates a barrier of protection, e.g., from wind, for an adjacent tree and for wildlife that might be occupying it. Its limbs must intermingle above or at the height of the canopy of the tree to be screened, while its tree top must be at least half the height of the tree to be screened.
C§9.4.3.2-3	Follow these procedures, if a tree to be screened does not have at least 4 screen trees, in order to assess and retain screen recruitment trees: ▪ Use 2 times the canopy spread as the distance within which to assess and retain potential screen trees. ▪ Ensure that a potential screen tree is the tallest tree in the assessment quadrant and at least ½ the height of the tree to be screened.  Tree To Be Screened **NOTE** If there are no trees which meet the criteria in C§9.4.3.2-3, do not retain additional trees.
C§9.4.3.2-4	Permit harvesting of a screen tree only if (a) there are at least 6 screen trees with intermingling limbs; (b) felling will not damage the tree to be screened; and (c) removing the harvested tree will not damage the tree to be screened.
C§9.4.3.2-5	Preserve all individual old-growth trees identified by size, characteristics, and dbh.
C§9.4.3.2-6	Obtain the approval of the wildlife agencies before initiating any burning in old-growth stands.
C§9.4.3.2-7	Cooperate if the wildlife agencies, on their own initiative, decide to re-introduce ecological burns in old-growth stands.

9.4.3.3 Residual old-growth trees

	Conservation Measures for Residual Old-growth Trees
C§9.4.3.3-1	Protect and preserve individual old-growth trees, both conifers and hardwoods. **NOTE** If MRC determines that we must cut a very large hard snag (i.e., >36 in. dbh and more than 20 ft tall) or an old-growth tree, we will provide written notification to the wildlife agencies about (a) our intent to fell the tree, (b) our reasons based on a thorough review, and (c) alternatives considered. If we do not receive a response from the wildlife agencies within 5 business days, we will fell the tree. MRC may fell other snags and wildlife trees for safety reasons without obtaining the approval of the wildlife agencies; in those instances, we will leave the felled trees on the forest floor and include the number of felled trees in an annual report (see C§9.2.3.1-4).
C§9.4.3.3-2	Retain all screen trees around individual old-growth trees per the guidelines in C§9.4.3.2-2 and C§9.4.3.2-3.

9.4.4 Rationale

9.4.4.1 Old growth and late seral forest

MRC conservation measures provide a functional ecosystem for the covered species and natural communities within our forestlands. Old growth, while not a natural community, is an important part of a functioning forest and plays a vital role for many species, such as the marbled murrelet. Over the course of HCP/NCCP implementation, some locations in the plan area will produce forests similar to late seral or old growth (Table 9-2).

Table 9-2 Sample Locations Trending to Late Seral or Old Growth

Plan Area (2010)		
Location	Current Acres	Silviculture
Class I and Class II AMZ	20,474	high retention
LACMA	1237	high retention
Easements (Comptche and Navarro Strip)	462	no harvest
Murrelet Habitat Recruitment Stands[21]	231	manage for murrelet habitat

Smaller areas throughout the property will also trend towards late seral or old-growth forest. These include high hazard terrain stability units, owl core areas that remain in the same location for long periods of time, and variable retention patches that we designated to protect a forest legacy (i.e., large snags). These areas provide the habitat elements required by species that are dependent on old growth and late seral structures.

MRC will not fell individual old-growth trees (except in rare situations); even an 80-year management plan cannot replace these trees. Our policies for retention and screen trees will offer protection to individual old-growth trees.

[21] See C§10.3.2.3.2-1 through C§10.3.2.3.2-3

9.4.4.2 Scientific literature

Loss of old-growth forest in the Pacific Northwest has created tremendous concern; potential loss of biological diversity accompanies its decline. Biological diversity can also be affected if the remaining pockets of old growth are too small to be ecologically viable. Estimates are that 76 animal species rely on old-growth as their primary breeding habitat while 65 animal species use it as their primary feeding habitat (Brown 1985). In addition, an unknown number of plants, lichens, and fungi depend on old growth.

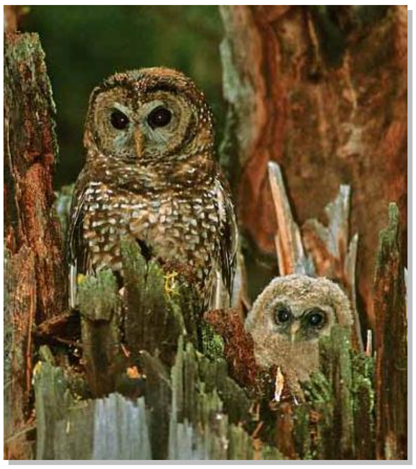


Photo by Jared Hobbs from USFWS 2010 Draft NSO Recoverv Plan

Dependence of many terrestrial organisms on old-growth features, such as snags, dead and downed woody material, and tree cavities, is well documented in the Pacific Northwest (Norse 1990, Ruggiero et al. 1991). Approximately one-third of vertebrates using western forests are "closely associated" with old-growth habitat (Olson et al. 2001). Most of these species use other types of habitat as well. However, in many cases, it is old-growth features that allow these species to persist in alternative habitats. For example, in British Columbia, black bear dens are found in second-growth forest, but primarily within structures (live trees, snags, or logs larger than 3.2 ft in diameter) that remain from a previous old-growth forest (Bunnell and Chan-McLeod 1997). Spotted owls may nest in second growth redwoods only because of the structural legacies left from previous old-growth stands (Noon and Murphy 1997). Additionally, Mazurek and Zielinski (2004) found that wildlife used individual old-growth trees more often than other trees. Individual old-growth trees had

- Greater species diversity and richness.
- Greater bat activity.
- Greater number of observable birds.

Certain species found primarily in old-growth forests persist in younger forests as well; nevertheless, they find optimum breeding and foraging habitat within old-growth ecosystems (Franklin et al. 1981). Moreover, many species are associated with old growth only for specific phases of their lives. For example, many Neotropical migrant birds spend their winters in Mexico or Central America, but rely on old-growth forest for breeding habitat. Also, many aquatic-breeding amphibians reproduce in lotic and lentic habitats within old-growth habitats, and move into upland areas after metamorphosis (Olson et al. 2001).

Sonoma tree vole
Photo from Oregon Natural Resources Council

Several species of mammals are dependent on old-growth structures for reproductive success, such as red tree voles in the Oregon Coast and Cascade Ranges (Corn and Bury 1991b, Gilbert and Allwine 1991b). This small arboreal rodent is an important prey of the northern spotted owl (Forsman et al. 1984). Although red tree voles usually build their nests in old-growth trees in Oregon and Washington, nests of Sonoma tree voles are also commonly observed in young second-growth trees in northern California (Carey 1989, Gillesberg and Carey 1991, both as cited in Carey 1991). Meiselman and Doyle (1996) found that certain forest characteristics contribute to habitat use by voles, including large diameter Douglas-fir trees, high percentage of canopy cover, high stump density, low snag density, and lower elevation. Several other small mammals are found in old growth in the Pacific Northwest, including deer mice, Trowbridge's shrew, and the shrew-mole (Gilbert and Allwine 1991b).

Population sizes of Pacific fishers and American martens have drastically dwindled in California. In fact, a 2008 survey in the plan area did not detect either species. These species are typically associated with mature, mesic forests with large diameter trees for resting and denning (Buskirk and Ruggiero 1994). While fur-trapping reduced populations of these species prior to the mid-1900s, habitat loss due to timber harvest is considered to be the major threat now facing them (Cooperider et al. 2000). Fishers and martens are likely affected by reduced canopy; smaller tree diameters; snag and log abundance; and changes in floristic composition. Canopy cover provides protection from predators, lowers the energy costs of travel between foraging sites, and provides more favorable microclimates (Buskirk and Ruggiero 1994, Powell and Zielinski 1994). Preferred prey species may be more abundant or vulnerable with greater canopy closure or coarse woody debris (Buskirk and Powell 1994). Moreover, as logging reduces the density of large trees, there are fewer denning and resting sites.

pallid bat

Bats represent another group of mammals linked to old growth. Recent research on the use of basal hollows by bats in old-growth redwoods confirmed that these hollows are important roost sites; this is evident from large quantities of bat guano in the hollows (Mazurek and Zielinski 2004). Further study determined that bats use hollows primarily in small, residual stands of old growth in commercial forests, as opposed to larger areas of un-fragmented old growth (Zielinski and Gellman 1999).

Studies of bird communities indicate that in old-growth forests there is a greater abundance and diversity of cavity-nesting species. In forests of the Oregon Coast Range, such birds included the pileated woodpecker, hairy woodpecker, red-breasted sapsucker, brown creeper, northern spotted owl, chestnut-backed chickadee, red-breasted nuthatch, and Vaux's swift (Carey et al. 1991). Similar results were found in forests of the Oregon Cascades (Gilbert and Allwine 1991c); additional species in old growth of this region were the rufous hummingbird, varied thrush, and winter wren. Another study in the southern Cascades Range of Washington found that old growth provided optimal habitat for all but 3 of 17 species (Manuwal 1991).

basal hollow

The marbled murrelet, listed in California as an endangered species, relies heavily on old-growth forest for breeding. General characteristics of preferred nesting habitat in the Pacific Northwest include a dominance of old-growth trees in a multistoried stand with moderate to high canopy closure (Miller et al. 1995); dense crown cover of old-growth trees was a dominant factor for stands occupied by marbled murrelets in northwestern California (Miller and Ralph 1996). The average canopy cover over identified nests is 85% (USFWS 1995a). In California, stand dominance by redwood, in conjunction with a dense canopy cover, is important in predicting marbled murrelet occupancy (Nelson 1997). A typical old-growth forest used for nesting by marbled murrelets is characterized by large trees greater than 32 in. (80 cm) dbh (Miller et al. 1995). Mature second-growth forest stands are not known to support nesting if they are isolated from old-growth forest stands (Larsen 1991, as cited in Miller et al. 1995).

Northern spotted owls in Oregon and Washington are generally found in old-growth forests characterized by more than 70% canopy closure, multi-layered canopy structure, large diameter trees, downed logs, and snags (Thomas et al. 1990, Buchanan 1991). Multi-layered canopy provides various microclimates, which help spotted owls regulate their body temperature and provide foraging, roosting, and nesting habitat. Spotted owl nests outside of coastal California are found mainly in mature stands. Spotted owls have also been located nesting in younger stands. Nests are found in tree or snag cavities, on platforms (abandoned raptor or raven nests, squirrel nests, mistletoe brooms, debris accumulations), or on top of broken-off snags. In more mature forests, spotted owls tend to use broken-top trees and cavities more frequently than platforms (LaHaye 1988, Buchanan 1991, Gutièrrez et al. 1995). In coastal Mendocino County, Pious (1994) noted that the majority of nests occurred in coastal redwood (73%), with fewer in Douglas fir (14%), and tanoak (8%).

Amphibians represent a distinctive and important component of the vertebrate fauna in old-growth ecosystems. Although the number of species occurring in Douglas fir and redwood forests is low relative to mammals and birds, amphibians are dominant in biomass in many habitats and supply an important proportion of the energy present in terrestrial and aquatic ecosystems. Researchers evaluated the habitat of 17 species of amphibians in forests throughout Oregon, in southern Washington, and in northern California. Of these, 6 species were found to be strongly associated with old-growth habitat in at least 1 of the survey regions (Corn and Bury 1991a). The coastal tailed frog and the southern torrent salamander—2 of the 6 species— occur in the plan area. These species are generally characterized by restricted distributions, specialized niches, and narrow climatic tolerances. Older, taller, and more structurally complex old-growth forests have greater daily and seasonal microclimate stability and relatively lower overall mean substrate and air temperatures than do younger forests (Harris 1984). They are, therefore, likely to provide higher-quality amphibian habitat.

Distinct invertebrate assemblages are associated with 3 primary habitats in Pacific Northwest old-growth forests: (1) the forest floor and understory; (2) the forest canopy; and (3) riparian habitats. Forest invertebrates drive many key ecological processes. They control decomposition and nutrient cycling; check epizootic outbreaks; catalyze natural disturbance and successional processes; and regulate growth and reproductive success of some fungi, plants, and vertebrates (Cooperrider et al. 2000). The forest floor harbors a large proportion of wingless and flightless invertebrates with low tolerances for changes in moisture and temperature (Lattin and Moldenke 1992, Frest and Johannes 1996, both as cited in Cooperrider et al. 2000). This group includes species of oribatid mites, harvestmen, millipedes, springtails, beetles, flies, wasps, spiders, crickets, land mollusks, and isopods. Some taxa lack a waxy cuticle, making them very susceptible to desiccation stress and restricting them to moist habitats. Some species are predictably associated with different combinations of soil temperature, moisture, structure, fungal abundance, limiting nutrients, and leaf litter (McIver et al. 1990, Moldenke 1990). Their specialized requirements make these species poor dispersers; populations and locally endemic species are prone to extinction. Many species of millipedes and harvestmen known only from single patches of old growth have not been collected again since these localities were logged

(Olson 1992, as cited in Cooperrider et al. 2000). Little is currently known about canopy invertebrates; the few studies that have been conducted indicate that the invertebrate fauna of this unique habitat is highly diverse and distinctive (Schowalter 1989; Winchester 1993, 1996, 1997; Winchester and Ring 1996).

Canopy arthropod faunas are dominated by phytophagous (plant-feeding) and predator/parasite guilds, a pattern typical of functionally diverse and complex ecosystems (Winchester and Ring 1996). Increasing evidence suggests that a sizeable component of the canopy biota consists of species restricted to specialized microhabitats, such as moss mats. If such species have limited geographic ranges, as observed for many forest floor invertebrates, then loss and fragmentation of old-growth forest will lead to increasing extinctions, perhaps before species are even discovered (Winchester and Ring 1996). Invertebrates associated with riparian and aquatic habitats in old growth are not well studied, but some species of stoneflies, caddisflies, and ground beetles are known to be restricted to these habitats. Removal of old-growth forests is known to severely affect streams and their biota (Frest and Johannes 1996, as cited in Cooperrider et al. 2000).
A number of fungi and plants characterize old-growth habitats. Relatively little information is available concerning the ecological relationships of these species in old-growth forests. Of the 46 species of hypogeous (subsoil) fungi identified in Douglas-fir forests of the Oregon Cascade Range, 41 were present in old-growth habitat; 6 of these were statistically associated with this habitat type (Ruggiero et al. 1991). Fungal diversity is very high in redwood forests; so far, 320 species have been identified. However, potential associations between fungi and old-growth conditions require further study. Douglas-fir and redwood forests also support nonvascular epiphytes including mosses, liverworts, cyanolichens, alectorioid lichens and other green algal lichens (Sawyer et al. 2000a). Little is known about the distributions of these plants through forest succession, though many, such as *Lobaria oregana*, a foliose canopy lichen occurring in Douglas-fir forests, appear to find optimal habitat in old-growth stands (Franklin et al. 1981, Spies 1991).

Vascular plants, particularly ferns, also occur as epiphytes in redwood and Douglas-fir forests. No vascular plants are known to occur exclusively in old growth, but a number of species are associated with this habitat (Ruggiero et al. 1991, Spies 1991). The strongest association currently documented is that of the Pacific yew (*Taxus brevifolia*), a very slow-growing, shade-tolerant species that appears to attain optimal growth and development in the understory of old-growth habitat (Spies and Franklin 1988, Ruggiero et al. 1991).

Much of the remaining old growth occurs in fragments that are too small to be ecologically viable because of edge effects. A forest less than 25 ac (10 ha) in area may be so vulnerable to edge effects, such as windthrow and increased rates of predation, that it may not serve as true old-growth habitat (Harris 1984, Franklin and Forman 1987). Similarly, old-growth redwood stands of less than 80 ac may not be viable because "outside influences can easily penetrate and because they are vulnerable to disturbances such as windthrow" (Morrison 1988). Russell and Jones (2001) found that 53% of the old-growth redwood forest preserved in Redwood National Park and state parks was influenced by edge effects, leaving only 47% as effective old growth. The minimum viable stand size for old growth ultimately depends on a number of factors, including the species composition of the stand, specific management objectives, the location of the stand in the landscape, and successional stages of neighboring stands (Spies and Franklin 1988).

By protecting both single residual trees and stands of old-growth trees, MRC will continue to maintain features typical of old-growth forests. Although the size and configuration of MRC old-growth stands varies, our implementation strategies for both un-harvested and previously harvested old-growth stands will protect and enhance the integrity and ecological viability of our existing old growth, regardless of stand size. The research highlighted in this sub-section underscores the importance of retaining these remnant stands of old growth; MRC old-growth policies provide substantial benefits to many species vitally connected to old-growth habitat.

9.5 Rocky outcrops

9.5.1 Overview

DEFINITION	**Rocky outcrops** are at least (a) 1 ac in size with ground cover entirely of rock or (b) near-vertical rock faces at least 50 ft high and 100 ft long whose appearance suggests they have never been quarried.

Rocky outcrops occur as isolated patches of bare or mostly bare rock in a variety of landscapes and habitat types. In the plan area, rocky outcrops are in 3 planning watersheds and cover a combined area of 63 ac (25 ha). We have provided a map of all known rocky outcrops in the plan area in Appendix B, *HCP/NCCP Atlas* (MAPS 3A-C, 4A-C, 8A-C, and 14A-C). Although rocky outcrops generally represent only a small fraction of the landscape, their unique qualities and insular nature make them important habitat for many plant and animal species, including the peregrine falcon. The thin, dry, rocky soils of rocky outcrops can support some types of woody vegetation but generally preclude large trees. This makes rocky outcrops of little value for timber harvest operations. In the plan area, rocky outcrops may include, but are not limited to cliffs, talus, and serpentine barrens.

In protecting rocky outcrops, MRC is focusing on the peregrine falcon, which uses this habitat for nesting. However, other species will clearly benefit from the fact that we are preserving this habitat and, when necessary, avoiding disturbance.

9.5.2 Goals and objectives

Goals and Objectives for Rocky Outcrops	
Goals	
G§9.5.2-1	Retain and preserve known rocky outcrops in the plan area.
G§9.5.2-2	Minimize disturbance of rocky outcrops.
G§9.5.2-3	Avoid adverse impacts to sensitive species that may inhabit or use rocky outcrops for reproduction, cover, or foraging, particularly the peregrine falcon.
Objectives	
O§9.5.2-1	Preserve and maintain 3 rocky outcrops comprising 63 ac (20 ha) across 3 planning watersheds.

9.5.3 Conservation measures

	Conservation Measures for Rocky Outcrops
C§9.5.3-1	Survey for peregrine falcon when timber operations occur within ½ mile of rocky outcrops or within 1 mile of any proposed helicopter yarding.

	Conservation Measures for Rocky Outcrops
C§9.5.3-2	Survey newly discovered rocky outcrops for sensitive species if there are plans to convert them to quarries. ▪ If sensitive species are not present, MRC may convert the site to a quarry. ▪ If sensitive species are present, MRC will obtain approval of the wildlife agencies prior to any conversion of the site to a quarry.
C§9.5.3-3	Coordinate with adjacent landowners, as appropriate, to determine the status of adjacent peregrine falcon eyries.
C§9.5.3-4	Consult with the wildlife agencies for operations within ¼ mile of a peregrine falcon nest in order to determine site-specific conservation measures, including disturbance measures.

9.5.4 Rationale

Rocky outcrops are structurally complex and stable; they provide cover from wind, rain, and sun. For many species, ranging from lichens to mammalian carnivores, rocky outcrops are islands of high-quality habitat in an otherwise inhospitable landscape. In forested habitat, canopy gaps created by rocky outcrops allow for the establishment of shade-intolerant plants; dry soils associated with these areas may support rare or sensitive plants and animals (BLM 2001, Imster 2001). In California, rocky outcrops can serve as nesting, roosting, or denning habitat for bats, woodrats, bobcats, mountain lions, grey foxes, ringtails, coyotes, raccoons, fishers, and skunks (Cato 2002, Zeiner et al. 1990a). In an Oregon lodgepole pine forest, American martens were documented, on at least one occasion, using rocky outcrops for a maternal den site (Raphael et al. 1997). Cliffs and steep rocky outcrops can be especially important as nesting sites for birds. Lizards and snakes also commonly use rocky outcrops for cover, foraging, and thermoregulation. MRC will avoid disturbance of these unique habitats and establish disturbance buffers, if needed, to protect nesting peregrine falcons and other sensitive species.

Bobcat from Hidden Camera
MRC Land, November 2004

9.6 Natural Communities

In section 1.11, we introduced the subject of natural communities in the plan area. Within our HCP/NCCP, we address North Coast coniferous forest, upland broadleaved forest, deciduous riparian forest, oak woodlands, closed-cone forest, and grasslands. The first 3 communities in this list, we designate as common natural forest communities and the last 4, as uncommon natural communities.

9.6.1 Common natural forest communities

9.6.1.1 Overview

This category applies to Northcoast coniferous forest, upland broadleaved forest, and riparian forest (see *HCP/NCCP Atlas*, MAP 8A-C). Natural communities can be stressed by many anthropogenic and environmental factors, including commercial development, population growth, and climate. While outright destruction of natural communities is obvious—such as the conversion of a conifer forest to vineyards—their alteration, fragmentation, and degradation can be much subtler and even concealed over a long period of time. This can be the result of roads, changes in water quality, spread of non-native species, forest management which results in over-simplification, modified ecological processes (e.g., fire regimes and grazing or browsing dynamics), and many other sources. Next to habitat loss, invasive non-native plants and animals may be the biggest threat to biodiversity. Invasive plant control is important for maintaining natural communities, especially when there is repeated soil disturbance from road maintenance, road construction, and logging.

Another important, though less obvious, threat to natural communities is the disruption of natural disturbance processes, most notably fire regimes. Not only does urbanization directly eliminate natural communities, it alters natural disturbance patterns. As areas urbanize, prevention and suppression of wildfire, for example, become more urgent and prescribed fire for ecological purposes becomes more difficult.

For natural communities with commercial timber value, timber harvest can also cause loss of species abundance through over-simplification of the coniferous forest. This is a primary threat to MRC natural communities.

9.6.1.2 Goals and objectives

MRC is not proposing to convert any of our existing natural communities to other land use. In the case of our conifer forest, harvesting obviously will occur. However, we will regenerate this same land, typically with stock derived regionally and with a mix of conifer species similar to the harvested stand. Using several silvicultural practices, we will maintain various successional stages of coastal forest. Actively managed upslope stands will vary from early to mid-seral stages throughout the term of our HCP/NCCP. The amount of late seral stands will increase as a result of the conservation measures for Class I and Large Class II watercourses. We estimate that late seral habitat within the plan area will increase from approximately 4300 ac in 2010 to 28,000 ac by Year 80 of HCP/NCCP implementation; this will be due mainly to increased protection of watercourse zones.

Goal and Objectives for Common Natural Communities	
Goal	
G§9.6.1.2-1	Maintain existing natural communities.
Objectives	
O§9.6.1.2-1	Regenerate harvested conifer forest with a mix of conifer species similar to the harvested stand.
O§9.6.1.2-2	Maintain various successional stages of coastal forest, including Type I and Type II old-growth stands as well as representative hardwood forests.

Goal and Objectives for Common Natural Communities	
Goal	
O§9.6.1.2-3	Maintain existing stand dominance of native conifers other than redwood and Douglas fir where this occurs.

9.6.1.3 Conservation measures

MRC conservation measures for natural communities directly correlate to the potential impacts these communities might incur as a result of covered activities. Our conservation measures are specific to a covered activity or covered species, not to a natural community per se. However, individual conservation measures taken in total can contribute both directly and indirectly to the conservation of natural communities.

MRC has "weighted" the conservation measures in areas where covered activities are most likely to occur. Mixed forest of coastal redwood and Douglas fir, mixed evergreen forest, and riparian forest comprise 98% of the plan area. Consequently, these areas face the greatest number of potential impacts from covered activities. By the same token, they also receive the lion's share of the conservation measures.

	Conservation Measures for Common Natural Communities
C§9.6.1.3-1	Restore coastal redwoods and Douglas fir.
C§9.6.1.3-2	Restore a balance of conifers-to-hardwoods.
C§9.6.1.3-3	Maintain Class I hardwood stands (section 9.3.1.2).
C§9.6.1.3-4	Maintain existing stand dominance of native conifers other than redwood and Douglas fir where this occurs.
C§9.6.1.3-5	Follow all other conservation strategies related to common natural communities: ▪ *Riparian areas and wetlands* Protect distinct habitat features, such as watercourses, marshes, seeps, and springs. ▪ *Sediment and mass wasting* Limit the anthropogenic sources of mass wasting, thereby maintaining more ground in the forest and less sediment impairment of watercourses. ▪ *Wildlife trees, snags, and downed wood* Retain and recruit habitat elements necessary to maintain a diverse habitat structure. ▪ *Hardwoods* Maintain hardwood tree species within MRC conifer forests, as well as representative hardwood stands across the plan area. ▪ *Old- growth trees* Retain old-growth trees, a significant habitat element. ▪ *Northern spotted owl* Create and retain older and denser forest stands; this, in turn, increases the diversity of seral stages throughout the natural community.

	Conservation Measures for Common Natural Communities
	▪ *Marbled murrelet* Retain large, uncommon trees with significant structural elements for nesting, such as platform branches or broken tops. ▪ *Point Arena mountain beaver* Retain existing burrow systems. ▪ *Rare plants* Protect and conserve covered rare plants.

9.6.1.4 Rationale

The ultimate threat to most of the natural communities in the MRC assessment area is habitat destruction and modification due to development and urbanization, such as vineyards and sub-divisions. The primary protection extended by MRC to the common natural communities within our forestlands is forest management that conserves species abundance and habitat diversity while promoting conifer-dominated forest and improving habitat for covered species. Appendix P, *Natural Community Schemes*, provides a "crosswalk" between MRC names for natural communities and other names used by various authors and alliances, as well as identified threats to these communities.

! MRC will map, with the assistance of the wildlife agencies, the natural communities in the plan area to the scheme of Sawyer and Keeler-Wolf.[22]

9.6.2 Uncommon natural forest communities

9.6.2.1 Overview

This category applies to (1) closed-coned forest (pygmy or Bishop pine); (2) oak woodlands; (3) natural grasslands; and (4) salt marsh (see *HCP/NCCP Atlas*, MAP 8A-C).

9.6.2.2 Goals and objectives

Goal and Objectives for Uncommon Natural Communities	
Goal	
G§9.6.2.2-1	Maintain existing natural communities.
Objectives	
O§9.6.2.2-1	Reintroduce and manage ecological processes or surrogates after obtaining approval of the wildlife agencies.

[22] Refer to Appendix P, *Natural Community Schemes*, Table P-1. The VegCAMP program (shown in column 2 of the table) uses the classification scheme of Sawyer and Keeler-Wolf 1995 and Sawyer, Keeler-Wolf, and Evens 2009.

Goal and Objectives for Uncommon Natural Communities	
Goal	
O§9.6.2.2-2	Conserve 3274 ac of uncommon natural communities by limiting MRC activities within them: ▪ 135 ac of pygmy forest. ▪ 319 ac of Bishop pine. ▪ 1084 ac of oak woodlands. ▪ 1669 ac of grasslands. ▪ 67 ac of salt marsh.
O§9.6.2.2-3	Control any species which the wildlife agencies and MRC designate as an exotic invasive.

9.6.2.3 Conservation measures

MRC will conserve these uncommon natural communities primarily by limiting our activities within them. When activities must occur, there will be strict levels of protection in place. By avoiding these communities during covered activities, however, disruption of natural processes, such as fire, becomes a threat. This may result in atypical communities or successional mixes. The following conservation strategies promote the overall health of these uncommon natural communities.

9.6.2.3.1 Closed-cone forest (pygmy or Bishop pine)

	Conservation Measures for Closed-cone Forest
C§9.6.2.3.1-1	Follow all conservation measures for rare plants detailed in Chapter 11.
C§9.6.2.3.1-2	Avoid conducting covered activities in closed-cone forest, if feasible.
C§9.6.2.3.1-3	Conduct covered activities in closed-cone forest to allow access to adjacent timber stands only if no other routes are feasible.
C§9.6.2.3.1-4	Conduct road maintenance and construction in accordance with the prescribed protections and take limitations on rare plants in Chapter 11.
C§9.6.2.3.1-5	Do not disturb, over the 80-year term of the plan, more than 5 ac of pygmy forest for construction of new facilities, such as roads, landings, and skid trails; obtain approval of the wildlife agencies if the proposed construction will impact additional acres.
C§9.6.2.3.1-6	Request technical assistance from USFWS, if necessary, to prevent take of the Lotis Blue Butterfly.
C§9.6.2.3.1-7	Apply surrogates for natural disturbance agents (e.g., fire) within natural communities, if the wildlife agencies concur.
C§9.6.2.3.1-8	Decommission, close, and re-vegetate historic roads (see Appendix E, *Roads, Landings, and Skid Trails*, section E.2.1)

9.6.2.3.2 Oak woodlands and natural grasslands

	Conservation Measures for Oak Woodlands and Natural Grasslands
C§9.6.2.3.2-1	Follow all conservation measures for rare plants detailed in Chapter 11.
C§9.6.2.3.2-2	Avoid conducting covered activities in oak woodlands and natural grasslands, if feasible.
C§9.6.2.3.2-3	Conduct covered activities in oak woodlands and natural grasslands to allow access to adjacent timber stands only if no other routes are feasible.
C§9.6.2.3.2-4	Conduct road maintenance and construction in accordance with the prescribed protections and take limitations on rare plants in Chapter 11.
C§9.6.2.3.2-5	Apply surrogates for natural disturbance agents (e.g., fire) within natural communities, if the wildlife agencies concur.
C§9.6.2.3.2-6	Decommission, close, and re-vegetate historic roads (see Appendix E, *Roads, Landings, and Skid Trails*, section E.2.1)
C§9.6.2.3.2-7	Harvest encroaching Douglas fir and avoid replanting the harvested area with conifers, if feasible and cost-efficient.

9.6.2.3.3 Salt-marsh

	Conservation Measures for Salt Marsh
C§9.6.2.3.3-1	Map, within 5 years of HCP/NCCP commencement, the boundaries of any salt marsh in the plan area with ground surveys, extending out at least as far as the dominant species identified, including Zostera spp.
C§9.6.2.3.3-2	Prohibit water drafting within the boundaries of the salt marsh.
C§9.6.2.3.3-3	Maintain a 50-ft EEZ (excluding existing roads) around a salt marsh.
C§9.6.2.3.3-4	Provide AMZ Class I protections around watered areas of the marsh.

9.6.2.4 Rationale

The primary protection extended by MRC to the uncommon natural communities within our forestlands is strictly limiting activities within them. Appendix P, *Natural Community Schemes*, provides a "crosswalk" between MRC names for natural communities and other names used by various authors and alliances, as well as identified threats to the these communities.

9.7 Invasive Species Management

9.7.1 Overview

Invasive species can pose a high risk to natural forest and wildlife communities (see Chapter 14, section 14.11). We have conservation measures to protect rare plants in close proximity to invasive plant species (C§11.7.1-19, C§11.7.2-21, C§11.7.3-15, and C§11.8.2-18). In addition, we have specific conservation measures to combat bullfrogs that invade ponds known to be breeding sites for red-legged frogs (C§10.2.2.3-6 and C§10.2.2.3-7). When feasible, MRC controls occurrences of invasive plant species. To date, our main efforts are targeted at jubata grass, broom, and eucalyptus.

9.7.2 Goals and objectives

Goal and Objectives for Invasive Species	
Goal	
G§9.7.2-1	Reduce the adverse ecological effects of invasive species in the plan area in order to enhance natural communities and protect covered species.
Objectives	
O§9.7.2-1	Eradicate or reduce the cover, biomass, and distribution of target, non-native invasive plants, such as jubata grass, broom, and eucalyptus, in the plan area through an Invasive Plant Control Program (IPCP).
O§9.7.2-2	Reduce the number and distribution of non-native, invasive animals, such as bullfrogs, if they threaten the ecological balance in natural communities or the populations of covered species.
O§9.7.2-3	Implement, with external or MRC funding and with the cooperation of the wildlife agencies as well as other land agencies, control programs for existing and newly discovered invasive species which benefit the region.

9.7.3 Conservation measures

MRC cannot effectively control many exotic plants and animals due to (a) their great abundance, high reproduction rate, and proficient dispersal ability; (b) the high cost of control measures; (c) the unacceptable environmental impacts of the control measures; or (d) public resistance to forms of control considered inhumane. Therefore, the focus of control efforts in the plan area will be on the most invasive non-native plants and animals.

Covered activities may specifically exacerbate the spread of invasive plants. For example, timber harvest operations may spread invasive plant seeds to remote areas. Logging roads may become dispersal corridors for invasive plant and animal species. Accordingly, MRC will implement a control program to minimize the adverse impacts of invasive plants and animals on covered species and enhance natural communities. Moreover, we expect our management efforts to increase the resilience of our natural communities to new invasions. MRC adopted and adapted the conservation measures detailed here as well as our Invasive Plant Control Program (IPCP) and Invasive Animal Control Program (IACP) from the Contra Costa County HCP/NCCP (Jones and Stokes, 2006) to address our own ecological setting and covered species.

	Conservation Measures for Invasive Species
C§9.7.3-1	Develop, within the first 5 years of HCP/NCCP implementation, an *Invasive Plant Control Program* and *Invasive Animal Control Program* for the plan area.
C§9.7.3-2	Incorporate applicable elements of the *Invasive Plant Control Program* and *Invasive Animal Control Program* into individual PTHPs and other site-specific projects.
C§9.7.3-3	Evaluate and revise the *Invasive Plant Control Program* and *Invasive Animal Control Program* as needed, with a formal evaluation and revision at least every 5 years.[23]
C§9.7.3-4	Continue current control efforts on invasive plants and animals in the plan area during development of the *Invasive Plant Control Program* and *Invasive Animal Control Program*

9.7.3.1 IPCP and IACP

The goals of the MRC Invasive Plant Control Program (IPCP) are to (1) control the spread of noxious weeds[24] and invasive exotic plants[25] into new areas and (2) control infestations of noxious and serious weeds, where practicable.

The Invasive Plant Control Program must distinguish those species for which eradication or control will be an objective of our HCP/NCCP and those species that MRC will address through landscape-level management.

The goals for the MRC Invasive Animal Control Program (IACP) are to (1) control invasive animal species where they directly threaten covered species or natural communities, (2) contain the spread of non-native invasive animal species, if they are within a small area, and (3) work in cooperation with local, state, and federal agencies to address invasive animal species that have spread throughout the plan area.

9.7.3.2 Elements of IPCP and the IACP

Both the IPCP and the IACP will include the following:

- Assessment of species likely to be invasive in the plan area.
  - Maps and descriptions of their distribution and abundance.
  - Known or potential effects on ecosystem function, native biological diversity, sensitive natural communities, and covered species.
  - Means and risk of their spread to other areas.
  - Cost, feasibility, and effectiveness of available control measures for each species.
- Assessment of species in locations near the plan area or in habitat similar to those in the plan area which pose potential threats.
  - Known or potential effects on ecosystem function, native biological diversity, sensitive natural communities, and covered species.

[23] This is the approximate interval at which the California Invasive Plant Council updates its list of invasive plants.
[24] Per the definition of noxious weeds by the California Department of Food and Agriculture
[25] See the latest listings of the California Invasive Plant Council at http://www.cal-ipc.org/.

- Establishment of priorities for invasive species control:
  - Level of impacts to sensitive natural communities and covered species.
  - Expected rate of spread.
  - Expected success of control measures.
  - Secondary environmental impacts of control measures.
  - Cost and technical feasibility of control.
  - Availability of external funding (e.g., state or federal grants).
- Integration and coordination of efforts to control invasive species in the plan area with similar efforts in other locations.
- Description and evaluation of methods to control and prevent the establishment of invasive species based on site-specific conditions.
- Process to evaluate future invasive species and to effectively remove or control them.

MRC will coordinate the development of our IPCP with the Mendocino County Agriculture Division, the Mendocino Coast Cooperative Weed Management Area, and other major resource management agencies, as appropriate. Because control of many invasive plants is a regional issue, coordination with these agencies is essential. Coordination may include sharing costs, staff, and equipment, as well as conducting joint management programs to address the regional problem of invasive plants. MRC will prioritize management to initially address invasive plants with the greatest impacts on covered species.

MRC will coordinate the development of our IACP with the wildlife agencies, and invite other local, regional, state, and federal groups to join in the control effort. To the maximum extent possible, we will cooperate with these groups. Control of invasive species which threaten covered species will be an MRC priority.

To date, MRC has had mixed results in controlling invasive species on our land. For invasive plants, the best way to control them is to treat the entire seed source of the plant. In locations where adjacent landowners do not treat the invasive plants on their property, MRC is seldom successful in controlling the plant. Seed blown from the adjacent property establishes itself on our land. Controlling species, such as jubata grass, under these circumstances is generally futile and unfeasible. MRC will maintain a database with information on all our attempts, both successful and unsuccessful, at invasive species management. Data will include species, location, treatment type, treatment timing, and post-treatment evaluation after 1-2 years.

MRC will be as proactive as possible by participating in regional planning and control efforts for invasive species and by highlighting issues and identification of invasive species in venues such as our Rare Plant Training Program (RPTP). This program emphasizes prevention and eradication of initial infestations; as such, it is the most effective management strategy for invasive species. Once invasive species become established, eradication efforts become more difficult and less effective; control measures become the norm. If authoritative sources determine that an invasive species is established, widespread, and beyond elimination, MRC may take other measures to control it which are consistent with our HCP/NCCP. Finally, to more effectively implement our IPCP and IACP, we will actively seek external funding sources to supplement HCP/NCCP funds, especially for invasive plant control.